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VIEWS, NEWS AND INTERVIEWS.

It is reported that there is a project on foot to combine all the trolley roads between New York city and Albany into one great system, and to build up a competitor to the New York Central. Ex-Governor Flower and his friends own most of the Hudson Valley trolley routes.

There are now 31 telephone companies in the State of Michigan, where there was but one 10 years ago. The telephone companies paid $41,086.78 in taxes this year, the appraisal valuation being $1,369,560. The Michigan Bell Telephone Company paid $26,358.32, the Detroit Company, $6,460.02, and the Citizens' Company, of Grand Rapids, $2,506.83, and the American Telephone and Telegraph Company, $1,620.37.

Mr. W. J. Bell is the manager of the Baraboo, Wis., Telephone Company. He is also unlucky. The other day, while making some repairs near Reedsburg, he stopped his horse in close proximity to some bushes. The animal stirred up a hornet's nest and made a sudden plunge forward as Mr. Bell was standing up doing some work. The manager was not prepared for this move, and sustained two broken ribs in falling backward. Bell has been struck by lightning, stunned by an electric wire, fallen from high poles, and had several other severe accidents.

The street-car conductor was not in good humor. Some one had passed a bad quarter upon him, says the Detroit *Free Press*, and that accounted for his starting the car before the three women and a child were fairly aboard.

One of the women was mad at being dumped without warning into a seat; the conductor saw that as he started to collect their fare, but he was mad, too.

"Madam," he said, as she tendered her fare, "this child that is with you will have to be paid for as well."

"I haven't the slightest idea of paying its fare," snapped the woman.

"Then I shall put it off," answered the conductor, reaching for the bell rope.

"You don't dare," flashed the woman.

Ting! The conductor brought the car to a stop, picked up the child and deposited it upon the street, and rang to go ahead.

"Madam," he said grimly, "you will find your child back there on the corner.

"My child?" snapped the woman. "It isn't mine."

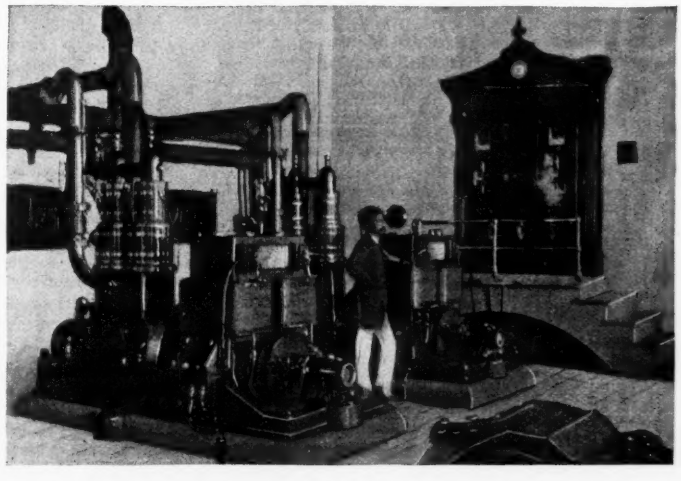
"Whose is it, then?" gasped the conductor.

"I haven't the slightest idea," she answered coolly.

Then the child's mother, who had been engaged in an exciting discussion with a friend over the merits of a new gown, awoke to the fact that her child was missing, and then the fireworks that played around the unfortunate conductor's head reminded him of a Fourth of July display.

A professional school of electricity is to be established near Paris, France. The school is intended to furnish laborers and foremen with an electrical education, and first-class instruction will be given in both theory and practice.

A Kansas paper recounts a story of the trouble innocently caused the Western Union and Postal telegraph companies by Bertha Leonard, a 13-year-old girl, living in Pawnee County. Her daily duty was to herd and watch a large drove of her father's cattle, whose range was near the Western Union and Postal telegraph lines. For some time past at irregular intervals during almost every day these lines absolutely failed to work, and the trouble seemed to be somewhere in the vicinity of where this girl ranged her father's cattle, but, try as the line repairers would, it could not be definitely located. Finally it was discovered that Bertha, in order to get a better view of the herd, had driven railroad spikes into a telegraph pole, so that she could climb it, and that she would, whenever she got weary watching the cattle from the ground, climb the pole, pull up a board by means of a cord, place it across the wires, seat herself on the board, and spend an hour or two watching the herd from her uniquely improvised elevated station. Whenever the board happened to be damp or wet, and the frequent rains this year have kept the board wet most all the time, it short-circuited the lines and practically cut off all telegraphic communication between Denver and Kansas City. When discovered and informed of the damage she was doing to the business of the telegraph lines, Bertha was greatly surprised, and was apparently utterly ignorant of the fact that her seat on the wires interfered in the slightest degree with the working of the lines.



ELECTRIC LIGHTING IN AN INDIAN PALACE—A CORNER OF THE DYNAMO ROOM.

Electric Lighting in an Indian Palace.

The largest and most important installation of its kind in the Bombay presidency, if not in the whole of India, is that recently completed for the Maharajah Gaikwar, of Baroda.

The generating station is situated in the palace grounds, and has attached to it an accumulator room, stores and small workshop. There are at present in position four Babcock & Wilcox boilers of 35 horse-power each, while space has been reserved for the addition of two more. They are fitted with a Green's economizer, the scrapers for which are worked by a small electric motor driven off the main circuit. A Worthington pump is at present used for feeding the boilers, but it is in contemplation to replace this by one electrically driven.

The dynamo room contains three separate plants: 1. The ordinary palace lighting plant, consisting of two sets of Willans compound engines and Silvertown dynamos, 220 volts and 185 amperes, each capable of running 1,100 lights of eight candle-power. 2. The night lighting plant, consisting of a Marshall engine and belt-driven dynamo. 3. The arc-lighting plant, consisting of two sets of Bumsted & Chandler engines and Silvertown dynamos, each set being capable of lighting 50 arc lamps in the gardens. The lamps are of the Brockie–Pell type, and are mounted on handsome columns. The lamps are placed in series parallel, each dynamo lighting five sets of 10 lamps.

The switchboards for the arc and for the incandescent circuits are elaborately fitted. The latter switchboard was supplied by the Silvertown company, but the former was made on the spot, advantage having been taken of the excellent quality of marble recently discovered in the Baroda territory. The instruments adopted are of the Kelvin pattern. The engine-house is completed by an overhead crane which runs its full length.

All cables (with the exception of the first few yards) are run under ground in wrought-iron tubes with the usual type of junction boxes.

A large set of chloride accumulators

has recently been added to the installation, and is utilized in the daytime for working two motor pumps; one of these is used for pumping the necessary water for the palace requirements and gardens, while the other is to be utilized in connection with the large fountain displays in front of the palace.

The preceding illustration, for which and the accompanying data we are indebted to London *Lightning*, shows a corner in the engine and dynamo-room of the lighting station.

Electric ceiling fans are being fitted in parts of the palace, having been found more satisfactory than the ordinary Indian punkah, especially at night, when the periodical slumbers of the punkah coolie are exasperating.

The work has been carried out under the supervision of Mr. Graham R. Lynn, M.I.C.E., chief engineer to the Baroda estate, and his electrician, Mr. Bagauna Balaji. The latter gentleman is at present on a trip to England studying the various systems in vogue there and on the Continent, with a view to further extensions on the Baroda estate.

RAILS—THEIR CONSTRUCTION FROM A SCIENTIFIC STANDPOINT.

READ BEFORE THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK, MANHATTAN BEACH, SEPTEMBER 14, 1898, BY A. J. MOXHAM.

Many years ago the London & North Western Railway Company, of England, reached the conclusion that what was known as a "soft" or low carbon rail gave the longest life, and its conclusions were honestly based upon what appeared to be clear-cut, practical experience. This was reenforced shortly afterwards by Professor Dudley, at that time acting for the Pennsylvania Railroad Company, who gave the result of tests that on the face of them were to be relied upon. His paper was an able contribution to the knowledge of the day. His general conclusions led to the "soft" rail, and he went further and endeavored to determine by comparison a factor for each special chemical ingredient. His conclusions created something akin to a sensation, and they were bitterly opposed by the steel experts of the time. Perhaps the fact that the steel manufacturer of that day was not sufficiently master of the situation to economically produce the ideal rail, according to Dr. Dudley's standard, may account for a good deal of the opposition. During the same period, however, notwithstanding these deductions, the tendency of the rail called for in actual practice was always to higher carbon. The writer himself during this interval was a supporter of the "soft" or ductile steel for rails; and even to this day, and in view of what is to follow, it is to the writer's mind a questionable thing whether a steel of great ductility and only of moderate hardness is not the steel for steam railroad purposes. It must be remembered, however, that the problem of wear upon a steam railroad is a very different thing from that of wear upon a street railroad. The rail in steam railroad use presents a clean head, because the rail is not buried. It has to oppose principally a rolling friction, for the number of times per mile that steam railroad trains are stopped is very few, taking a general average. The street rail, on the other hand, has not only to meet this rolling friction, but has to contend with the grit from the surrounding roadbed, and with stops every few feet. Not only are the stops incomparably more frequent, but they are again multiplied into a greater number of units, as many individual cars are the rule on street railroads as against the occasional train of the steam road.

Being unable to reach positive conclusions from the published authorities, and from personal contact with the steel experts of the country, or even from our own experience, it was determined to conduct experiments to this end.

It was accepted, to begin with, that it would be folly to try to finesse in the matter; that the best that could be done would be to try to find general, safe indications. When it is remembered that each chemical ingredient puts its own particular stamp upon the steel, and a different stamp in each particular combination with the other ingredients, and that the number of such combinations may be infinite; when it is remembered that each different heat at which the steel is rolled affects the problem; that the amount of draft put upon each successive pass should not be ignored, the necessity of this conclusion becomes evident. Hence the present effort is not to pass upon the proportion of each particular thing, be it good or bad; it is not a search for the perfect steel; but only a prayer that light may be shown in the right direction.

The experiments have lasted for three years. The first endeavor was to take broadly a "soft" steel and a "hard" steel for the rails to be tested, securing the difference by carbon alone, leaving all other ingredients as nearly as possible the same. The experiment with these was started in October, 1895, and has been continuous ever since. In June, 1896, additional rails were added to the experiment, supplied by the West End Street Railway Company, of Boston, who at that time had determined (with wisdom, as will be seen subsequently) upon a steel both hard and ductile. The conclusions, therefore, are based upon what may be described as soft steel, hard steel, and steel both hard and ductile.

The rails (some 33 in all) were laid in the South Eighth street tracks of the Nassau Electric Railroad, of Brooklyn. They were laid continuously, so that the same car is obliged to pass over every rail, and therefore each rail is subject to the same wear, and the wear on the head only is considered. Street traffic is ignored. The point was selected as one that would give great wear in a short time, in order to reach early conclusions, as the cars pass this point at extremely short intervals.

Every rail has been measured at two points, taking about 10 feet from each end, in order to eliminate the special wear at the joints. Each rail has two cast-iron boxes bolted to the outside, at the points to be measured, to permit access for purposes of measurement without disturbing the roadbed. Originally the wear was registered both by actual measurement and by taking an impression of the head of the rail by means of type-metal castings. Two slots were provided in the tram of the rail to guide the type-metal mould. Notwithstanding the great care that was exercised in taking the impressions, this method of measurement was quickly given up, as the results were far from being as accurate as those taken by micrometer calipers. With these calipers measurements of each rail were taken at three points across the head of the rail, point number one being at a point near the gauge line, point number two being nearly in the center of the head and point number three being nearer the outside of the head.

Speaking accurately, point number one is two inches; point number two is one and three-eighth inches, and point number three is seven-eighth inch, all from the outside of a head two and one-fourth inches wide. Methods were adopted for accurately locating the same lines, so that the comparisons in the different measurements of wear could be relied upon.

There were seventeen rails of low carbon (viz., averaging .28); 14 rails containing high carbon (viz., .59), and two were West End rails. The least wear shown was in the West End rail, the hard rail follows a good second, while the greatest wear is shown in the soft rail.

	Soft.	Hard.	West End.
Carbon	.280	.59	.570
Silicon	.026	.056	.234
Phosphorus	.106	.097	.050
Sulphur	.066	.059	.078
Manganese	.790	.84	.980
	1.268	1.632	1.912
Iron	98.732	98.368	98.088
	100.	100.	100.
Special grade	7.855	7.841	7.825
Based on iron only, ignoring the metalloids	7.956	7.971	7.977

The average monthly wear amounted to .0007 for the West End rail, .0012 for the hard rail and .0017 for the soft rail. The results of the experiments are conclusive on this point. We will, therefore, in the subsequent analysis start with this as a fact. We will refer first to the physical test, and take last the question of chemical compositions.

(To be concluded.)

A Valuable Book on Cuba.

Charles Scribner's Sons, New York, have just published a large octavo volume, entitled "Commercial Cuba: A Book for Business Men," by William J. Clark, general manager of the General Electric Company's railway department. The book is embellished with eight maps, seven plans of cities and 40 full-page illustrations. There is an introduction by E. Sherman Gould, member of the American Society of Civil Engineers.

The well nigh limitless field for business enterprises which Cuba offers for United States capital gives this carefully prepared and authoritative work especial timeliness. Mr. Clark, who has been for many years at the head of the railway department of the General Electric Company, is recognized as a statistician of exceptional ability, whose word carries great weight.

The facts which he has packed into this book, the sources of his information being personal observation supplemented by official reports, give an exhaustive picture of the conditions and possibilities of every industry on the island, each town and each district being critically examined with a view to the outlook for American capital backed by American energy. The chapters deal with social and hygienic questions, legal procedure, political matters, public improvements, railways, both steam and electric, turnpikes and roads, harbor and dock facilities, telegraph, cable and telephone lines, contract labor, agriculture, mining and manufacture in all of its branches, and a multitude of other subjects of interest to business men who are looking to Cuba as a field for investment or as a market for goods.

The maps, plans and illustrations, together with the commercial directory of the island in the appendix, emphasize the encyclopedic and exhaustive character of the work. The price of the book is $4 and it may be ordered through the Electrical Review Publishing Company, Times Building, New York.

Illinois State Telephone Association.

The convention of the Illinois State Telephone Association, an organization of independent companies, which was to have been held last week at Du Quoin, Ill., has been postponed. The convention will meet at Bloomington, Ill., some time in November, the exact date to be announced later.

Lundell Power Motors.

Lundell high and medium-speed motors have been on the market for the past 10 years. During that time they have become widely and favorably known for their many good qualities. There is nothing in their construction of undetermined or experimental character, as the manufacturers long ago recognized the fact that if electric machinery was to be accepted with entire confidence on the part of users, it must be at least standardized to the same extent as the machines with which it was designed electric motors should be used.

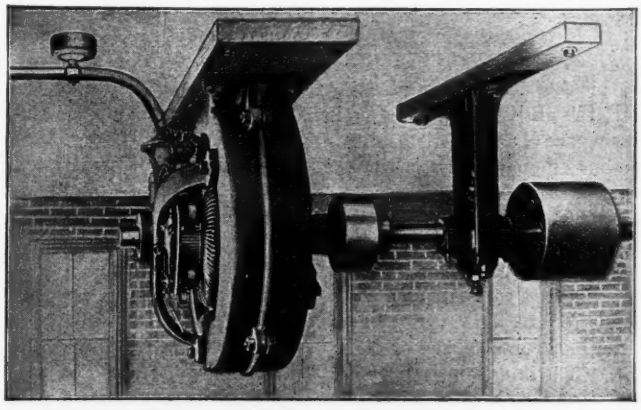
Although it may be claimed that the liability of breakage or deterioration by wear is less with an electric motor than with any other piece of machinery doing an equal amount of work, at the same time they are not invulnerable to accident, and when this does occur it is highly desirable that the damaged part can be replaced with rapidity and cheapness. In these days of highly economized time the manufacturer has little inclination for expensive delays and is not to be blamed for avoiding machinery which would be likely to lead him into trouble of that nature.

Of late there has been an increasing demand for motors suitable for coupling direct to line shafts or to the driving shafts of machines, and a line of Lundell slow speed motors, embodying all the good points of the high-speed machines and embracing many new ideas and improvements, as the result of extended experience, was designed and offered to the public. Two years' practical test seems to have demonstrated that there was no element of weakness in their design and construction. The wisdom of building them strong, compact, simple and easy of unskilled manipulation has secured for this particular type of motor an unusual popularity.

While the use of individual motors in connection with machines requiring over one or two horse-power to operate is to be recommended on account of entirely dispensing with shafting and belting, and securing wider range of flexibility and floor economy, there are yet many instances where it is desirable in operating a number of small machines, each calling for a limited amount of power, to belt these to a line shaft operated by a single large motor.

The motor illustrated is now made in standard sizes from one-half to 15 horse-power, all having a uniform speed of 150 revolutions per minute at the rated output. This speed, it will be noticed, corresponds to the usual speed of line shafting and driving shafts of machines, which ordinarily run at a speed of from 150 to 300 revolutions per minute. The motors, however, can be wound for higher or lower speeds with proportionately greater or lesser output.

Lundell slow-speed motors are carefully constructed on scientific princi ples, are self-contained and thoroughly capable of withstanding the rough usage and great strain to which machines of this class are subjected. The armature and field-coil are well protected, reducing to a minimum all chances of accident. They run smoothly and successfully in an inverted, semi-inverted or horizontal position, and can be placed at any desired angle. They may be suspended from ceiling and coupled directly to the line shaft, or built into the machine as direct-connected motors, having the armature keyed directly on the driving shaft.



LUNDELL SLOW-SPEED MOTOR SUSPENDED FROM CEILING.

A starting rheostat is furnished, which has devices for the protection of the motor in case there should be a cessation of the current or the motor should be overloaded from any cause. This starting rheostat provides for only one constant speed, but as motors of this class are frequently required to run at several different speeds, a speed controller will be furnished, when specified, giving from five to ten different speeds.

All Lundell motors present a neat and attractive appearance, being usually heavily enameled in black. However, the manufacturers state that they can be finished to match any machine to which they are to be attached or to otherwise harmonize with their surroundings.

The Sprague Electric Company, No. 20 Broad Street, New York, are the sole manufacturers of the Lundell motors and will cheerfully mail printed matter and all information on request.

PERSONAL.

Capt. T. H. Brady, of New Britain, Ct., one of the pioneers in the field of electrical manufacturing, was a New York visitor last week.

Prof. Alexander Graham Bell was a recent visitor to San Francisco as the guest of President John I. Sabin, of the Sunset Telephone and Telegraph Company. Professor Bell, accompanied by his wife, is on his way to Japan.

Passed assistant engineer W. D. Weaver has been detached from the "Glacier," and ordered home. Mr. Weaver is the editor of the *American Electrician*, and has served in the navy throughout the war. He is a graduate of the Naval Academy, at Annapolis, and resigned from the service several years ago to enter electrical journalism.

Mr. William S. Hine, of Chicago, has joined the staff of the Western Electric Company, and will be in charge of the sale of Stanley alternating-current apparatus for which the Western Electric Company recently secured the agency in several western states. Mr. Hine is well and favorably known to the fraternity, and the Western Electric Company is to be congratulated on securing his services.

Michigan Electric Company Burned Out.

The electrical supply house of the Michigan Electric Company, at Detroit, was completely destroyed by fire on September 24. President Jos. E. Lockwood and treasurer Geo. A. Mansfield inform the ELECTRICAL REVIEW that temporary quarters have been secured at 106 Woodward avenue, Detroit, and that the business of the company is being carried on as usual. A new stock of electrical material is being rapidly secured, and orders will be filled with but little, if any, delay. Work on new permanent quarters is being pushed, and the Michigan Electric Company will be, in a very short time, in better condition for business than ever before.

The Niagara Falls Transmission Line Baffles a Tornado.

When J. G. White & Company, the well known engineers and contractors, of New York city, designed the Niagara Falls–Buffalo electric transmission line, they were criticised by some people for figuring on such a great factor of safety as they did. The importance of being certain that the line would withstand any kind of a storm, seemed to make a large factor of safety necessary. That this view of the question was the correct one is shown by the facts related in the following letter:

MESSRS. J. G. WHITE & CO.,
29 Broadway, New York, N. Y.

GENTLEMEN — You may have noticed in the newspapers accounts of damage done by the tornado, which, on the 26th inst., swept across Grand Island and destroyed a great deal of property in the village of Tonawanda.

It will interest you to know that, although the houses, barns and other dwellings were blown down and several lives lost, the transmission line of the Niagara Falls Power Company, across which the tornado passed, did not lose an insulator, nor was the continuity of the current interrupted for one second.

We believe that you will be gratified to know that the factor of safety upon which you based the construction of this line was well considered, and that the care with which the construction was completed baffles even tornadoes. Very truly yours,

THE CATARACT CONSTRUCTION COMPANY,
By William B. Rankine, secretary.
New York, September 30.

Brooklyn, N. Y., Electric Lighting Deal Completed.

On Saturday last the final arrangements were completed under which the Kings County Electric Light and Power Company, of Brooklyn, N. Y., absorbs the Edison Electric Illuminating Company, of Brooklyn. The Edison company had previously acquired the Citizens' Illuminating Company and the Municipal Electric Light Company, both of Brooklyn. The final purchase of the Edison company by the Kings County Electric Light and Power Company places the latter in control of the electric lighting and power business in Brooklyn. The officials of this company are all men of experience in the electrical and financial worlds, and will be enabled to give to Brooklyn the economical and efficient electrical service such as a city of its magnitude and importance is entitled to and which the combination of the old and new plants assures.

Mr. Anthony N. Brady, on behalf of the Kings County company, and Mr. George Foster Peabody, on behalf of the Edison company, completed the consolidation—the largest ever made in the electric illuminating field.

SCIENCE ABSTRACTS.

The following extracts of interest to our scientific readers are from the official publication of the Institution of Electrical Engineers, London, edited by Mr. J. Swinburne:

Evidence that Roentgen Rays are Ordinary Light. G. J. Stoney—This inquiry is based upon Sir George Stokes's explanation of Roentgen rays, which amounts to this: That cathode rays consist of negatively charged missiles, shot in showers like hedge-firing from the negative electrode against a target which receives and suddenly arrests them; and that the Roentgen rays are due to the independent pulses propagated through the ether when the advances of their negative charges are thus abruptly stopped or altered. According to this view, the radiation from the target reaches the object which is being skiagraphed as an undulation consisting of irregular pulses The present inquiry is as to what part of this irregular undulation can pass through the object and arrive at the fluorescent screen beyond. This is ascertained by showing that the undulation of irregular pulses can be resolved into trains of waves of different wave-lengths, among which waves of short wave-length are abundant if the hedge-firing have been sufficiently violent and irregular. The resolution is effected by combining MacCullagh's method of analysis with Fourier's in such a way as secures that the resolution is a physical one, and not merely kinematical. The radiation which traverses the space between the target and the object becomes thus the same physical event as the coexistence in that space of the trains of waves of various wave-lengths indicated by this method, which are such that each train has an actual physical existence and advances through the ether independently of the rest. All these constituent trains encounter the object, which is of such a kind that it is opaque to those of longer wave-length, while it allows those of short wave-length to pass on and reach the fluorescent screen. These, accordingly, are what produce the Roentgen effect. The more violent, abrupt and irregular the hedge-firing, the more abundant will these essential constituents of short wave-length be.

Insulation Tests for Cable Joints. E. Raymond-Barker—The author applies the principle of the "method of mixtures" to ascertain the resistance of a joint in gutta-percha or other core. Electrical connections are arranged as in the "Thomson" capacity test, the two ratio resistances being replaced by two short lengths of core submerged in water. One of these lengths contains the joint to be tested, the other is a piece of similar core of equal length without a joint. Two standard mica condensers, each of one microfarad, are used for the capacity ratios. The quantity of electricity that leaks into either condenser in a given time—say, one minute—depends upon the dielectric resistance of the corresponding piece of core. If the joint on that side is faulty, the defect shows itself when the galvanometer key is depressed. This test has all the advantage of a null method; it requires only the ordinary apparatus of core testing, and it appears to be more expeditious than previous joint tests.

Condensers for Induction Coils. P. Dubois—As already pointed out by Walter, the utility of a condenser in increasing the electro-motive force in an induction coil ceases when the capacity of the condenser surpasses a certain value. The author determines the most useful capacities for secondary circuits of various resistances. These capacities vary from three microfarads for 225 ohms to 0.2 microfarad for 5,225 ohms in the secondary circuit. The insertion of 10 microfarads stops all physiological action of the secondary current. The author's measurements were carried out with an electro-dynamometer.

Effects of Heating on Magnetic Properties of Iron. S. R. Roget—The paper contains some results of a series of experiments on the change of hysteresis in soft-iron transformer plate, due to continued heating for various different temperatures. The specimens, initially in the annealed state, were heated in small ovens, and removed periodically to be tested in Professor Ewing's hysteresis tester at atmospheric temperature. Below 40 degrees centigrade no evidence was found of any change. Between 40 degrees centigrade and 135 degrees centigrade the hysteresis increased with time, at first rapidly, and slower later. At higher temperatures the value of the hysteresis reaches a maximum, and then decreases; for example, at 160 degrees centigrade the hysteresis doubled in a few hours and nearly trebled in a few days, afterwards falling. Beyond about 180 degrees centigrade the hysteresis, although rising more rapidly at first, does not reach so high a maximum value and begins to fall sooner and faster, tending apparently to a lower steady state the higher the temperature. For example, at 260 degrees centigrade the maximum was already passed in 15 minutes, a steady state only 50 per cent above the original hysteresis being reached in about 15 days. In all cases the original state was restored by reannealing. Ballistic curves are also given for a ring of similar material, before and after heating.

Cowper-Coles Gold-Recovery Process. S. Cowper-Coles—The principal feature of the Cowper-Coles process for the recovery of gold from cyanide solutions is the use of an aluminum cathode, which overcomes one of the chief difficulties appertaining to the economical recovery of gold from weak cyanide solutions by electrolysis. In the Siemens-Halske process lead foil or lead strips are used, the cutting up of which is a tedious matter. If several sheets are cut superimposed, the strips cling together, and have to be carefully spread out one by one, so that the surface may be exposed to the solution. A clean-up is made every seven to eight weeks, when the wood frames carrying the lead strips are withdrawn, the lead strips removed and new substituted, the auriferous lead being ultimately melted down and conveyed to a central works to be cupelled. This method is both crude and expensive, the labor of fitting the strips into the frames is considerable, and the consumption of lead is a large item, having been computed by Von Gernet at the Worcester mine at 1.10 of a penny per ton of ore treated. The author overcomes these difficulties by substituting aluminum plates for the lead foil, advantage being taken of the fact that a loose oxide is formed on the surface of the aluminum which enables the deposited gold to be readily stripped or wiped from the cathodes as pure gold. Gold by this process has been successfully extracted from cyanide solutions containing only .01 per cent of potassium, two and one half pennyweights of gold to the ton of solution. The substitution of aluminum for lead foil or strip enables the gold to be obtained as pure gold, and also daily returns to be made of the amount of gold recovered; it has also the additional advantage of reducing the cost of labor and economizing the amount of cyanide of potassium used, as the solution is not contaminated by any base metals, such as zinc, as in the McArthur Forest process.

Insulators for High-Tension Lines. Electricien—The paper is a description, with scale-drawings, of new types of insulators for overhead lines capable of sustaining pressures up to 10,000 volts. They are manufactured by Burns et C^ie^, Paris. The insulator for 2,000 volts has one internal petticoat only, but the outer surface of this has four ribs, or what may be termed horizontal petticoats; this insulator, eight centimetres high and nine centimetres in diameter, presents a length of insulating surface of 26 centimetres. The insulator for 10,000 volts has two internal petticoats, the outer one quite short, and the inner provided with two horizontal petticoats; the upper of these nearly touches the outer petticoat, and the lower passing below it nearly touches the inner surface of the insulator bell. This arrangement produces three nearly closed annular chambers, into which it is difficult for moisture or dust to penetrate. The larger size, nine centimetres high by 115 centimetres in diameter, has an insulating surface 30 centimetres long. A heavy type is made for withstanding side pulls up to 400 pounds. For lower pressures, to take heavy pulls up to 600 pounds, as at angles or at the ends of lines, the insulator is held by a vertical bolt passing through it and fixed to an iron fork; above and below the central groove for the wire is a double petticoat. A high-tension line switch is constructed as follows: An iron rod is fixed to a cross-piece on the pole, its ends passing through caps cemented on to the tops of two insulators; pins cemented into these insulators terminate below into spring contacts, and contact is made by a metal bar provided with insulating handle. This bar is prevented from slipping out of the contacts by a copper wire passing through contact piece and bar, and fine enough to break easily in pulling down the bar. This bar is also made to take a fuse.

Non-Insulation of Bolts in Armatures. J. Fischer-Hinnen — It is generally believed that the non-insulation of the extremities of bolts, which traverse the stampings of armatures, may lead to losses of energy, since a closed circuit is formed by the bolts and the two-end stampings of the armature. The author investigates the subject theoretically, purposely assuming conditions most likely to give exaggerated results, and finds that in the case of a 180-kilowatt machine the loss due to six bolts is only 5.3 watts. He concludes, therefore, that the loss is in general negligible.

REDETERMINATION OF THE AMPERE.

REPORT OF THE COMMITTEE ON STANDARDS OF MEASUREMENT TO THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The determination of the mechanical equivalent of heat by the electrical method, as reported by Griffiths (Phil. Trans., A 1893) and by Schuster and Gannon (Proc. Roy. Soc., November, 1894), gave a larger value than Rowland's corrected result. This fact has created a demand for the redetermination of the ampere in terms of the electro-chemical equivalent of silver. At the Toronto meeting of the British Association last year a grant was made to the British Association Committee on Electrical Measurements for the purpose of carrying out this investigation.

At the Detroit meeting of this association the grant of $50 previously made for the use of this committee was made available for the past year. Though this appropriation was clearly insufficient for the purpose, it was decided that the redetermination of the ampere should be undertaken for the committee of this association in the physical laboratory at Ann Arbor. The work has been ably carried to completion by Professor Patterson and Dr. Guthe.

The discrepancy between Griffiths's results and those of Rowland is about one part in 400 at all temperatures between 15 and 25 degrees on the nitrogen scale. Those of Schuster and Gannon exceed Rowland's at 19.°1 on the same scale by about one part in 500 (Johns Hopkins University circulars, June, 1898). These differences exist after the final elaborate comparison of thermometers and the reductions to the same absolute scale of temperature.

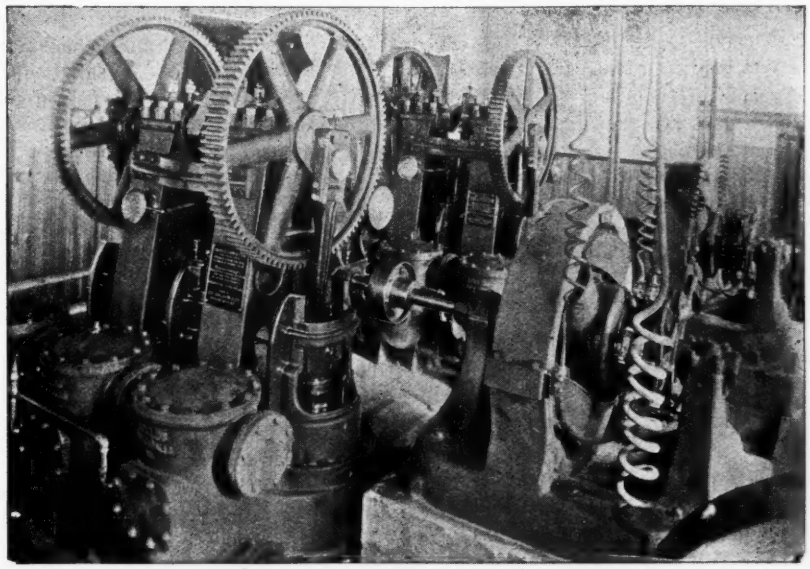
Since the electrical methods employed to determine the mechanical equivalent of heat involve either the current and the electro-motive force of the Clark cell, or the square of this electro motive force, and since the electro-motive force of the Clark cell is determined by means of the silver voltameter, it is evident that the current enters the final result as the square. If the discrepancy is due entirely to an error in the value of the ampere, assuming the ohm to be correct, then the ampere should be one part in 1,000 to one part in 800 larger than the present accepted value. That is, the electro-chemical equivalent of silver should be increased from Lord Rayleigh's value of 0.001118 to 0.0011191 or 0.0011194. Lord Rayleigh does not claim for his result an accuracy greater than one part in 1,000.

The method used by Patterson and Guthe was that of a specially constructed electro-dynamometer of large dimensions, and the employment of the torque of a phosphor-bronze wire to equilibrate the counter torque due to the effort between the magnetic fields of the stationary and movable coils. This method eliminates entirely the value of gravity g. The torque of the wire was measured by observing the period of vibration of a cylindrical brass weight of known mass and dimensions when suspended by the phosphor-bronze wire. The entire success of this part of the investigation was due to the fact that the observations were made with the whole apparatus enclosed in a fairly good vacuum. Under these conditions the vibrations could be followed for hours at various intervals; the logarithmic decrement was almost entirely constant, and it was easy to obtain a curve connecting temperatures and periods of vibration as a torsional pendulum. The wire was so connected to the support and to the brass cylinder that it could be transferred from the vacuum apparatus to the electro-dynamometer and back again without disconnecting it from the terminal pins. From personal inspection at the several stages of the investigation assurance can be given that the work has been most carefully executed at every point, and all known sources of error have been as completely eliminated as possible. The weights employed were compared with the standards at the United States Bureau of Weights and Measures in Washington; the standard of length was a half meter bar of speculum metal made for the University of Michigan by the late Prof. W. A. Rogers. The time was taken from a standard Riefler clock checked by comparison with the observatory time. The result of the investigation is that the electro chemical equivalent of a used solution of neutral silver nitrate, 15 parts by weight of the silver salt to 85 parts of distilled water, is 0.0011192 gram per ampere per second. This exceeds Lord Rayleigh's value by about one-ninth of one per cent and causes the discrepancy in the mechanical equivalent of heat to disappear.

The corresponding change in the electro motive force of the Clark cell will be from 1.4342 to 1.4327 at 15 degrees centigrade. A direct determination has not yet been made and this redetermination is reserved for the coming year.

Dr. Kahle has obtained for the electro-chemical equivalent of silver the value 0.0011182 (Wied. Annal., vol. 59, page 532) by the use of an electro-dynamometer designed by von Helmholtz and a fresh solution of the salt. Pellat and Potier found the same value as that of Patterson and Guthe (Journ. de Phys. 9, page 381, 1890).

HENRY S. CARHART,
Secretary Committee.



ELECTRIC PUMPING PLANT AT DE KALB, ILL.

Electric Pumping Plant at De Kalb, Ill.

There are numerous cases which might be cited to show that electric power may be used profitably to supersede any other form of power. A striking instance is afforded in the case of the waterworks plant at De Kalb, Ill., near Chicago.

For years this city pumped the water supply with a direct-acting steam pump, at an expense of over 10 cents per 1,000 gallons. Then the city installed a set of electric pumps, made by the Goulds Manufacturing Company, of Seneca Falls, N. Y. The water is now pumped at less than half the former cost.

A local electric light and power company furnish current and attend to the pumping at a fixed price per 1,000 gallons.

They pump at intervals when the engines and generators are underloaded by the regular light and power work, requiring no extra help and but little additional fuel. There are two triplex pumps, each of 750,000 gallons daily capacity. They are driven by General Electric motors. The city waterworks now shows a profit where there was formerly an expense.

The Electrical Exchange Assigns.

The Electrical Exchange, which, since November, 1896, has been engaged in the sale of new and second-hand electrical apparatus, at 174 Clinton street, Chicago, made an assignment on September 22 in the County Court for the benefit of its creditors to L. O. Gilman. The assets and liabilities of the company are estimated at $12,000 each. The officers of the company are: President, T. S. Lane; secretary, R. R. Lane; treasurer, H. L. B. Cannon.

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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SPECIAL NOTICE TO ADVERTISERS.
CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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The suits for infringement, which have been in the courts for a long time, brought by the American Bell Telephone Company against the National Telephone Company, the Century Telephone Company and others, will be argued during the coming Winter. A great mass of testimony has already been taken.

As far as the ELECTRICAL REVIEW is informed, Col. Theodore Roosevelt is not connected in any way with the electrical industry. And yet we feel sure that all broad-thinking electrical men are glad he is running as the Republican candidate for governor of New York state. His proved courage, his integrity and ability, his true American manliness and his magnetic personality make him an ideal candidate, and will secure for him many votes outside of his own party.

The telegraph and telephone will soon revolutionize the business life in Porto Rico, our newest colony. There are other islands adjacent that should properly become the property of the United States, in fact the Lesser Antilles, as a whole, could probably be secured at a small comparative cost from the various nations owning them. It is understood that the Danish islands of St. Croix and others have been offered to the United States. With cables to all these islands, and the cities and towns connected by a network of telephone lines, their control and development is not a task that need worry our statesmen.

Mr. George C. Sperry is the superintendent of telegraph for the Mexican Central Railway. A new title has been added to his name—a new honor thrust upon him—and hereafter he will be known as "Mosquito Commissioner." It was brought about in this way: "A few grains of permanganate of potash will, it is claimed, destroy all the embryo mosquitoes in a very large area of mosquito swamp. At two cents an acre all the mosquitoes can be killed off for a space of 30 days, and as the breeding time is but two months, four cents will insure protection for the entire year. This places it within the possibility of a state, and certainly a city, to entirely rid itself of a great nuisance. April and May are the two months in which the mosquito breeds. They are purely local in their habits, and not migratory, as some suppose, and they seldom move more than 100 feet from the place of their birth. Hence to exterminate the breed in a certain locality would rid that locality of the pest for that season at least, and the method of extermination is so inexpensive that an entire community may be rid of them at a very small expense." Mr. Sperry is expected to rid Mexico, at least that part traversed by his road, of the mosquito. New Jerseyites and others will await with interest the result of his efforts.

THE EXTENSION OF THE TELEGRAPH AND TELEPHONE SERVICE OF THE B. & O. RAILROAD.

The rehabilitation of the B. & O. system in track, bridges and rolling stock, has recently been brought frequently into notice by the press.

The present energetic management recognizes that the telegraph is one of the great factors by means of which successful operation is accomplished. They recently decided to increase their wire facilities, and further increases are anticipated. Mr. Charles Selden is the superintendent of telegraph, and is one of the leading electricians of the United States.

For the present there is in process of construction two hard drawn, large gauge, copper wires, extending from Baltimore to Pittsburgh, and one of them will be continued to Newark, Ohio. These lines are "transposed" at frequent intervals, so as to enable the company to use them for telephonic purposes. It is the intention to give to the superintendent of transportation direct telephonic and telegraphic communication with principal points lying between Pittsburgh and Baltimore, as well as other terminals.

A great deal of time may be saved by telephonic communication, and the number of telegrams which would otherwise be transmitted is greatly reduced, as the full discussion can take place at the same rate of speed as ordinary conversation, rather than at the comparatively slow rate of speed of Morse transmission.

Within a very few years the expiration of certain patents will enable the company to use the wires simultaneously for Morse and telephonic communication, and the Baltimore & Ohio Railroad Company is taking an advanced step so as to be prepared to avail itself, in the fullest sense, of all the good results that can be had from telephonic as well as telegraphic communication.

GREAT ACTIVITY OF THE LARGE MANUFACTURING COMPANIES.

An undisputable evidence of the tendency towards a healthier aspect of the business situation is the greater activity in the shops of the manufacturers of electrical machinery for heavy work. The large establishments of the several electric companies appear to be in a most active condition; the Westinghouse community of interests, near Pittsburgh, are in a decidedly prosperous state; so also those of the General Electric at Schenectady. The Walker Company at Cleveland and New Haven are said to have nearly two millions of dollars of orders for heavy electrical machinery now in hand and in course of execution. The large factories of the Stanley Electric Manufacturing Company at Pittsfield, Mass., where the "S. K. C." system of polyphase alternating-current machinery is made, are operating under pressure with a full complement of men, and a representative of the ELECTRICAL REVIEW was recently informed by one of the management of the organization that the prospects were extremely bright for still greater demands; the Crocker-Wheeler factories at Ampere, N. J., where the construction of "direct" generators and other forms of dynamic machinery has been brought to a high degree of development, indicate the renewed business confidence, and consequent placing of large orders is plainly evident. The Eddy Company, of Windsor, is very busy, and reports in general from other manufacturers indicate a renewal of business activity in the electrical field of most encouraging nature.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

Political conventions, the assembling of the Peace Commission at Paris and a whirl of speculation in several industrial stocks tended to conceal the actual financial situation during the past week. The majority of the regular stocks showed an unusual firmness in spite of these circumstances, but as compared with the previous Saturday the majority of stocks were lower. Hereafter the old issue of General Electric stock, both common and preferred, will not be quoted on the exchange, the new issue taking its place.

On the New York exchange, General Electric (old) closed at 48 bid and 48½ asked, showing a loss of ¾ point. General Electric (new) closed at 79 bid and 80 asked, a decline of 3⅜ points for the week. Edison Illuminating of New York closed at 131½ bid and 134 asked.

On the Boston exchange, American Bell closed at 278 bid and 279 asked. Erie Telephone closed at 74 bid and 75 asked.

On the Philadelphia exchange, Electric Storage Battery common closed at 39 bid and 39¼ asked.

Wall Street, October 1.

THE PHOTOMETRY OF THE ENCLOSED ALTERNATING ARC.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, SEPTEMBER 28, 1898, BY CHARLES P. MATTHEWS, W. H. THOMPSON AND J. E. HILBISH.

The enclosed arc of the direct-current type has received a noteworthy development at the hands of Marks* and subsequent workers. It has been the subject of more or less experimental study by Houston and Kennelly, Freedman,† Hesketh,‡ Nichols§ and a number of others on both sides of the Atlantic. The enclosed arc of the alternating-current type is of somewhat more recent development and has received less attention experimentally. It was with the thought of observing something of the behavior of this latter type of illuminant that the data of the following pages were taken.

Arc light photometry, in so far as it involves the mere determination of luminous intensity,‖ yields unsatisfactory results for three chief reasons: The first of these is the marked difference in quality between the light of the arc and that of any of the ordinary standards. The photometrist realizes the general unsatisfactory character of the existing standards¶ for the study of sources of a quality similar to that of gas light. Nevertheless, he is vastly better off in this respect than he is in the matter of a standard of suitable quality and intensity for arc light measurement. The eye estimates accurately an equality of brightness in two surfaces only when those surfaces are of the same tint. Moreover, with a color difference, the judgment of an equality differs with different observers. It should be said, however, that the difficulty arising from difference of color is less troublesome in the case of the enclosed arc than in the case of its progenitor, the open arc. The inner, opalescent globe absorbs the rays of short wave-length in greatest proportion, a fact which brings the color of the arc nearer that of the standard. When an outer globe of milky glass is used—the standard being a glow lamp maintained at or above its normal voltage—there is no annoyance from color difference.

The second obstacle to careful measurement is to be found in the variability of the quantity to be measured. These variations are largely due to the wandering condition of the arc—a peculiarity that is especially noticeable in the open alternating arc, and in both types of the enclosed arc. Indeed, it is to this feature of the enclosed arc that the flat-ended carbons are due. The change in luminous intensity corresponding to a shifting in the position of the arc from one side of the carbons to the other side is enormous. Curves of horizontal intensity showing the magnitude of these changes have already been published.* An attempt to get at the intensity of such a source by a few readings might easily lead to results discordant by 100 per cent or more. The only hope of securing a result that will show the mean intensity of the arc is in taking a large number of settings, distributed, as to time with some degree of uniformity. To accomplish this it would seem desirable to do away with the considerable and variable interval of time used in the ordinary process in reading the bar. This end was reached by the use of a mechanical device for recording a setting as soon as it is made. The essentials of this device will be readily understood from an inspection of Fig. 1. Its collateral advantages, for the study of personal error and for other photometric uses, have been dwelt upon in a note published elsewhere.† For our present purpose, it is sufficient to point out that it permits the observer to keep his eye continually trained on the photometer disk, so that all the major fluctuations may be readily followed and recorded, and this, too, without the visual fatigue resulting from introducing light into the photometer room. The act of depressing the rod *r* makes a permanent record on the paper surrounding the drum, and at the same time advances the drum so that the record may be subsequently identified.

The inaccuracy of photometric settings, due to the causes just mentioned, is perhaps more a question of process than of principle. There is a third, and more fundamental source of trouble—one, indeed, which brings into question the validity of the term "candle-power" as a measure of worth in illuminants. For the sake of clearness, let us first consider what the term means. A 16 candle-power lamp, for example, is one that produces at a distance of four units the same illumination that one candle produces at one unit. That is, if two similar surfaces be illuminated separately by these two sources at these distances, and if they be viewed in juxtaposition from the same direction, they appear equally bright. This is, in fact, what the photometer shows, and is really all that can be affirmed with a result of the comparison. Having established a distance ratio of 4 : 1, the observer applies the law of inverse square to calculate an intensity ratio of 16 : 1. This intensity ratio is numerically equal to the illumination ratio on two surfaces at unit distance, but it is important to note that an observer would be quite unable to assign a numerical value to the relative illumination of these surfaces. In other words, the optical stimulus varies as the inverse square, but, by Fechner's law, the sensation varies as the logarithm of the stimulus—a fact of which we can not take direct cognizance. Thus the intensity or "candle-power" ratio of two sources is a derived quantity, of indirect significance, whose chief value is to be found in the fact that it enables one to calculate an indefinite number of pairs of distances, at each of which will be found an equality of illumination. If two sources be compared by some method which takes account of their quality, and which gives as a result the ratio of their total luminosities—determined, say, by the relative value of their component rays in distinguishing characters—something quite different from their "candle-power" ratio may be obtained. These matters have already been brought to the attention of the members of the Institute by Nichols.* Fortunately, the luminosity ratio of sources of nearly the same color is not widely different from their intensity ratio. Hence it is to be hoped that, in the acetylene flame or some similar source, we shall soon have a suitable standard for the photometry of the arc.

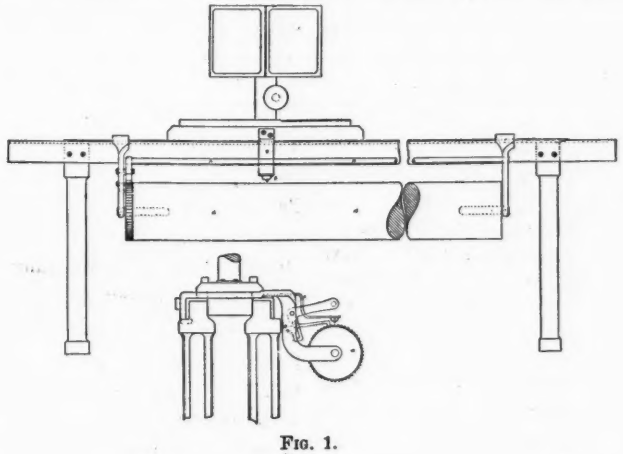


FIG. 1.

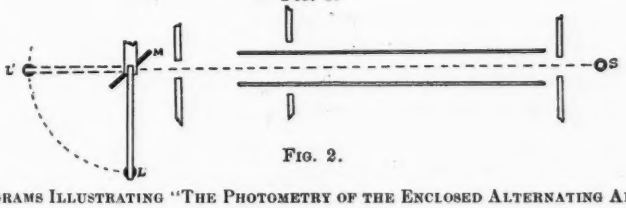


FIG. 2.

DIAGRAMS ILLUSTRATING "THE PHOTOMETRY OF THE ENCLOSED ALTERNATING ARC."

For the photometric measurements, a Krüss–Bunsen photometer was used. The method adopted was the usual one of a swinging crane in connection with a 45-degree mirror. The total distance between sources was 829 centimetres. The coefficient of reflection of the mirror was determined by the use of two glow lamps connected in multiple. The lamp nearest the mirror was mounted at the end of an arm capable of being swung through an angle of 90 degrees as indicated in Figure 2. This arrangement maintains the same length of bar with and without the mirror—a fact which makes for simplicity in the calculations. For the coefficient of reflection the first values obtained by three different observers were :

H, .828 T, .826 M, .823

An inspection of the image of the arc in the mirror gave rise to the belief that the absorption of the luminous rays was in some degree selective—an undue proportion of the violet rays being taken up. Were this the case, the value of the coefficient determined by glow lamps would be incorrect for use with the arc itself. To test this matter, the electro-motive force on the lamps was varied through a wide range and a determination made for each change. The values found were:

TABLE I.

Volts on Lamps.	Reflecting Power.
95	.824
105	.805
112	.785
117	.800
122	.782
127	.836
132	.808
137	.825

Although the change in the quality of the light was very marked in this experiment, the results do not indicate any regular change in the coefficient of reflection, such as was looked for. Hence, in all subsequent measurements, the mean of these various determinations, namely .814, was used.

The standard source was a glow lamp; it was referred after each test to the Hefner lamp. Electrical measurements were made by various portable voltmeters, ammeters and wattmeters, all of which were repeatedly referred to Kelvin balances.

(To be continued)

* London *Electrician*, xxxviii, 615; March 5, 1897. See also Proc. Electrical Congress, Chicago, 1893.

† Transactions, xiv, 341; August, 1897.

‡ London *Electrician*, xxxviii, 793.

§ Sibley *Journal of Engineering*, xi, 369; June, 1896.

‖ That our photometric nomenclature needs standardizing can not be doubted. The quantity that has been called candle-power is hardly appropriate if the Hefner unit be used. If we have arrived at the passing of the candle, should not candle-power go? This same quantity is variously styled intensity, total intensity (Palaz.), luminous intensity and brightness (Nichols). The unit of illumination also goes by several names.

¶ Nichols, *loc. cit.*

* See report of Nichols, Sharp & Matthews, Transactions, xiii, p. 133, May, 1896.

† Current number of the *Physical Review*.

* Transactions, vi: 1-8, May, 1889.

New York Edison Company Reduces Prices.

The Edison Electric Illuminating Company of New York, through Mr. R. R. Bowker, first vice-president, has issued to its customers the following circular, under date of October 1:

The Edison company, in accord with its declared policy of reducing prices and encouraging the more general consumption of electric current, particularly for long-hour use, and in continuation of the reductions announced in its circular letter of October 28, 1897, will replace its present schedules for both incandescent and arc lighting by the reduced rates scheduled below, on bills due after October 15, 1898 (including partially September lighting).

These rates give customers the benefit of the fact that electricity for long-hour use can be produced and sold cheaper than any rival illuminant. A consumer using one lamp eight hours a day requires an investment in station apparatus and street conductors only one-eighth that required by a consumer using eight lamps one hour a day, though the consumption for one day is the same in both cases. Although operating costs, for coal and other supplies, varying almost directly with the amount of electricity produced, do not show a like saving, yet the long-hour user can be supplied at a much lower rate per hour than the short-hour user, reaching half or less proportion of the one hour price.

For retail use, 20 cents per kilowatt-hour (equivalent to one cent per 16-candle-power, 50-watt incandescent lamp-hour, or 10 cents per standard arc lamp-hour) for first hour's average daily use of the total lamp equivalent connected; 15 cents (three quarter cent or seven and one half cents) for the second hour; 10 cents (one-half cent or five cents) for the third and fourth hours, and five cents (one-quarter cent or two and one-half cents) for all use above four hours.

For wholesale use, with a guarantee of 2,000 kilowatt-hours' consumption each month and two hours' average daily use of installation, 10 cents per kilowatt hour for the first four hours' average daily use and five cents for all use above four hours or, at the option of the consumer, the present wholesale or kilowatt rate of ten, nine, eight and seven cents per kilowatt-hour for two, four, six and eight hours' average daily use, with reductions for quantity, etc.

These prices cover both incandescent and arc lighting, and include renewal of incandescent lamps (not exceeding one 16-candle power lamp for each 20 kilowatt-hours) and the carbons and trimmings for arc lamps, but not first supply of lamps. The company, however, in accordance with general practice, waives, for the present, the last condition and continues, until further notice, the first supply of incandescent lamps.

All prices are net cash, but on the new schedules, five per cent on bills of $500, and 10 per cent on bills of $1,000 in one month, will be allowed on the net bill for payment within 10 days after presentation of bill.

Household elevators, pumps, etc., may be included at the retail rate without separate metering or separate minimum charge. To encourage cooking, heating, etc., by electricity, household apparatus for cooking, heating and ventilating will, until further notice, be excluded in reckoning installation. Thus the cost of lighting will be relatively diminished by the use of current for these purposes.

These prices will be made for the period October to December, inclusive, 1898, with the intention, should results justify, of making them permanent, and possibly of still further reducing rates for long-hour use or making a maximum rate equivalent to three-fourths of a cent per 16 candle-power incandescent lamp hour. Contracts will be made at the above prices, however, for a full year. Plans to reduce rates for power service are under consideration.

In accordance with the practice of the company of giving to present customers all advantages offered for new business, their bills will be rendered, without revision of contract, at the reduced rates for this period, or a revised contract for one year may be made by present customers.

Should there be exceptional cases in which customers' bills under the old rates would be less than under the new schedule, bills of present customers, until further notice, will be rendered at whichever is the lower rate, or a corresponding rebate will be made at the close of the October-December period.

Customers will note that to obtain their illumination most cheaply and to best advantage under these new rates they will find it to their interest to use electricity for all their lighting, in place of other illuminants. It is the desire of the company that each customer should obtain his lighting at the lowest possible price, as the best surety for the continuance of satisfactory relations between the supply company and the consumer, and it is always ready, through capable representatives, to consult with individual customers as to how illumination may be so handled or distributed as to give the best results for the least money.

OBITUARY.

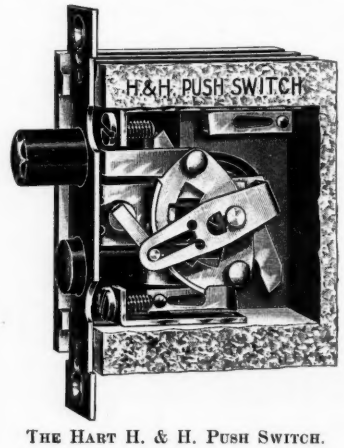
William T. Ryle, the millionaire silk manufacturer, of Paterson, N. J., died at Cape May, N. J., on September 21, after a brief illness. In addition to his silk business, Mr. Ryle became interested in electric lighting, and had for many years been the president of the Edison Electric Illuminating Company, of Paterson. He had been a close personal friend of Thomas A. Edison for some time.

The Cleveland, Ohio, Electric Railway has declared a quarterly dividend of one per cent, payable in October.

The Hart H. & H. Push Switch.

A problem which has annoyed switch manufacturers for years has been to devise a push switch making quick and positive contact, moved by a mechanism operating with the least possible effort. The Hart & Hegeman Manufacturing Company, of Hartford, Ct., claimed to have solved this problem in the new push switch illustrated herewith. Its ease of operation has already secured for it great popularity, especially for use in residences, hotels and other places where women and children use switches.

The accompanying illustration shows the operating mechanism. The switch is enclosed in one piece of porcelain. The contacts are of the "knife switch" form. The switch-



THE HART H. & H. PUSH SWITCH.

plates are thoroughly insulated from the mechanism. The action is positive, the break long and the carrying capacity is ample. It is wired from the front, and the ease with which wiring can be done has been warmly commended by wiremen. The switch has been tested and approved by the National Board of Fire Underwriters. The Hart & Hegeman Manufacturing Company report the receipt of letters from prominent electrical engineers in all parts of the country congratulating them on the result of their effort in the push switch line. Through the courtesy of one of the largest central stations in the country an exhaustive test of the switch was made in the inspection department, and the report received from their chief inspector read as follows:

"The switch tested was a double-pole, flush snap switch, incased in porcelain, except the front, which was of plain nickel, and rubber push buttons, one marked to indicate light. The action of the switch was quick and positive, breaking the circuit in four places The switch was designed for 220 volts—10 amperes. The test consisted of making and breaking the circuit as follows: 115 volts, 15 amperes, 1,500 times; 230 volts, 15 amperes, 1,500 times; 230 volts, 20 amperes, 200 times. The switch worked perfectly free and no undue heating or arcing was observed. At the end the switch was taken apart for examination and was found in good order, hardly showing that it had been used. No disastrous effect of arcing could be detected."

Personal Reminiscences of Dr. John Hopkinson.

The following personal reminiscences of the late Dr. John Hopkinson, the English electrical inventor and engineer, who recently lost his life in the Alps, were written by Mr. John Raworth for the London *Lightning:*

"The daily papers speak of the three-wire system as one of Dr. Hopkinson's greatest achievements. It has certainly been a useful one, but I have no doubt he produced it in five minutes; it was a happy idea, but it was by pure luck that there was so much money behind it. For my own part, I should say that the electrical industry owes him more for his excellent work in the development of the theory of the dynamo. Dr. Hopkinson taught the whole world how to build dynamos. While Edison was producing dynamos with magnets like organ pipes, and Siemens with magnets like the ribs of a cow, Hopkinson was continually saying, 'Make them shorter and fatter.' But the prophets of Woolwich put wool, or rather more wool, in their ears, until one day they discovered the fact for themselves; and then up went the price of iron.

"'More iron' was, of course, not a patentable idea, so it is probable that Dr. John did not make much out of it; but he was lucky, very lucky, with some of his patents. For instance, somewhere in the early eighties he patented every conceivable contrivance for turning over the brushes of a motor to make it reversible. Dr. C. W. Siemens was so impressed with the belief that Dr. Hopkinson had covered the whole ground that he took a sole license on a very substantial minimum royalty; but before reversible motors were wanted Dr. Hopkinson's own improvements in dynamo construction had so far reduced the lead of the brushes that it became unnecessary to turn them over.

"It is a curious feature of this incident that the two most penetrating minds of the time in matters electrical should not have foreseen the possibility of this development."

THE MAGNETIC DEFLECTION OF DIFFUSELY REFLECTED CATHODE RAYS.

READ BEFORE THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, BOSTON, SEPTEMBER, 1898, BY ERNEST MERRITT.

It is now known that X rays are developed in a Crookes tube at all places where the cathode rays encounter a solid obstacle. In the tubes now made the cathode rays are usually "focused" on a piece of sheet platinum, and the X rays proceed from this focus. But other rays are developed at this point as well as Roentgen rays, and are the cause of the brilliant fluorescence which usually covers about half the glass of such tubes. These rays are deflected by a magnet-like cathode rays; in this they differ from X rays, which are entirely unaffected by the most powerful magnetic fields. Goldstein, who first observed these rays, believed them to be cathode rays that had been diffusely reflected from the platinum, just as light would be scattered by a roughened surface. S P. Thompson believed that the rays were intermediate between cathode rays and X rays, and has proposed for them the name "para-cathodic rays."

The author has measured the deflection of the "para-cathodic rays" in a given magnetic field, and compared it with the magnetic deflection of the direct cathode rays in the same tube. No difference could be detected in the behavior of the two sets of rays. This fact must be looked upon as an argument in favor of Goldstein's view. According to the generally accepted theory, cathode rays consist of small negatively charged particles repelled at enormous speed from the cathode. It seems probable that when these particles strike an obstacle some are stopped and by their impact produce the X rays; a few of the particles may, however, rebound like elastic balls. The particles that rebound will then travel off with practically undiminished velocity and will form the "para-cathodic rays," possessing all the properties of the original cathode rays. The author is, therefore, of the opinion that the "para-cathodic rays" are really the same as cathode rays, and result from diffuse reflection.

The Centenary of Gas Lighting.

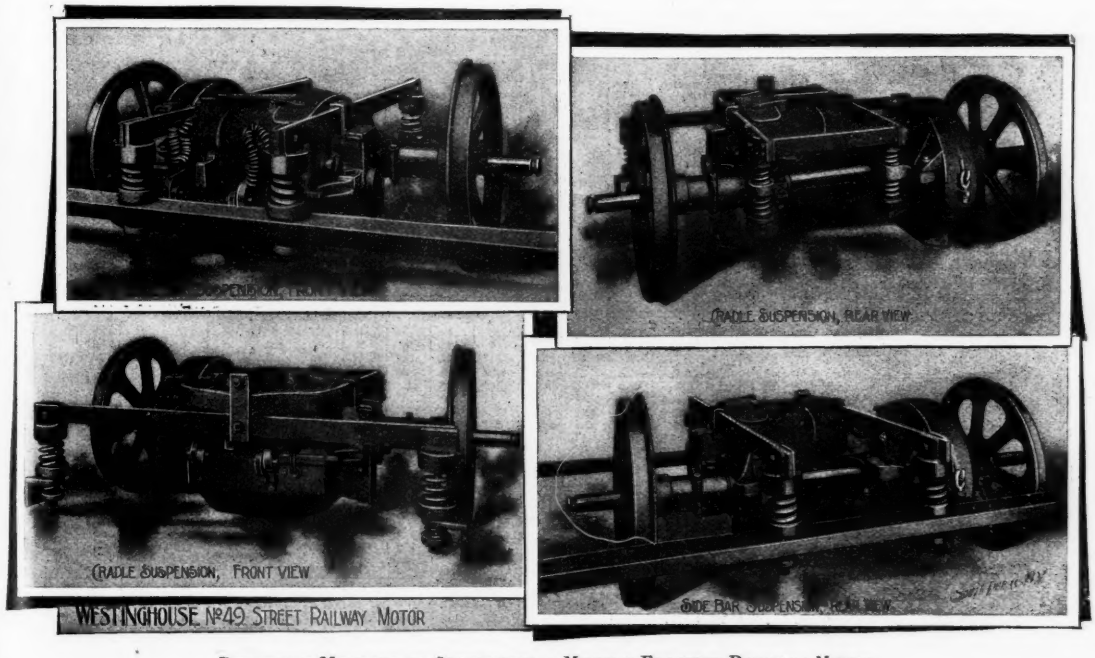
Electricity has now so largely supplanted the older methods of illumination that people have almost forgotten says a London paper, that this year is the centenary of gas lighting, coal gas having been first applied to economic uses by William Murdoch in 1798, although it was not introduced into London until 1807. In 1825, when meter reckoning came into general use, the rate charged was 15s. per 1,000 cubic feet, subject to a discount of five per cent for prompt payment. At a later date 12s. was charged, and in 1834, three years before Queen Victoria ascended the throne, a further reduction was made, the price becoming 10s. per 1,000 cubic feet.

The Westinghouse No. 49 Railway Motor.

The part played by the Westinghouse Electric and Manufacturing Company in the development of the electric railway motor is well known to street railway men. Although not the first manufacturing company to build a railway motor, the Westinghouse company, since beginning to manufacture railway motors in 1890, has constantly exhibited an enterprise which placed its products in the front rank.

In October, 1894, the Westinghouse No. 12–A motor was offered in response to the demand for a dust and water-proof railway motor. It was, it is claimed, the first absolutely "weather-proof" motor, and was adaptable to either standard or narrow gauge. The design was for either 25 or 30 horse-power, slow or high speed. Early in 1895 the ventilated armature winding, with all the attending advantages, was introduced on this motor.

The demand for a motor which should be more powerful than the No. 12–A resulted, in February, 1897, in the production of the Westinghouse No. 49 motor, illustrated herewith. At 590 revolutions per minute, this motor develops 35 horse-power. It is designed for either nose or side-bar suspension, and notwithstanding the increase in power, it is 330 pounds lighter than No. 12–A, the total weight being but 1,920 pounds. Experience has shown the Westinghouse No. 49 motor to be exceptionally efficient.



DIFFERENT METHODS OF SUSPENDING A MODERN ELECTRIC RAILWAY MOTOR.

ELECTRIC RAILWAY NOTES.

General manager J. B. Parsons has been elected president of the Union Traction Company, of Philadelphia, *vice* John Lowber Welsh, resigned. Mr. George T. Widener has been elected vice-president.

An injunction was granted on September 19 against the defendant in the case of Sprague Electric Railway and Motor Company vs. Detroit Citizens' Street Railway Company for infringement, especially of claims 2 and 6 of Patent No. 324,892, granted to Frank J. Sprague, August 25, 1885.

The report of the Waterbury, Ct, Traction Company for nine months shows: Gross earnings, $117,469.70; operating expenses, $67,906.74; net earnings, $49,562.96. The number of cars is 56; miles traveled, 435,431; persons carried, 2,515,110; number of employés, 85; length of road, 14.86 miles.

The annual report of the Long Island, N. Y., Electric Railway Company, for the year ended June 30, shows that the number of passengers carried during the year was 735,567. The length of the road (single track) is 15½ miles. The 50 employés received $33,290 in wages. Ten persons were injured. The sum of $1,067 was expended for injuries and damages. The company operates 33 motor cars.

At the annual meeting of the stockholders of the Charlottesville, Va, and Suburban Street Car Company, the following directors were elected: T. O. Troy, John B. Moon, Walter Dinwiddie, A. N. Peyton, H. M. Lewis, C. J. Rixey, L. T. Hanckel and W. Graham Page. The directors elected the following officers: President, T. O. Troy; vice president and counsel, Daniel Harmon, and secretary, F. B. Peyton, whose terms of office began on October 1.

President Albert Johnson, of the Nassau Electric Railway Company, of Brooklyn, N. Y., said to a reporter for a New York paper last week that the consolidation of his road with the Brooklyn Heights road would probably be accomplished within two weeks. He said: "I shall either sell my stock in the Nassau company and get out entirely, or I shall retain my stock and resign as president of the Nassau. After consolidation the Heights system will, of course, be in control." Mr. Johnson predicted that in a short time all the trolley roads and the elevated roads will be consolidated and operated under one management, and he thought the scheme would be best for all the interests concerned as well as for the public.

COST OF ELECTRIC POWER FOR STREET RAILWAYS AT THE SWITCHBOARD—STEAM AND WATER-POWER.

READ BEFORE THE AMERICAN STREET RAILWAY ASSOCIATION, BOSTON, SEPTEMBER 9, 1898, BY R. W. CONANT.

(Continued from page 203.)

Reducing price per ton to price per pound and multiplying by 2.2 gives 33 cents as the cost of coal per kilowatt-hour. This appears in table No. 1 under cost of fuel. As an illustration of what the cost would have been had the engines required more steam, say, 26.6 pounds per indicated horse-power hour, as might be the case with a non-condensing engine. Referring to the fuel diagram and considering the electrical efficiency, boiler evaporation and price of coal to remain the same, 26.6 to 9.4 pounds water per pound of coal gives 3.8 pounds of coal per kilowatt-hour. Following this line down to horizontal three dollar-coal line and vertically upward from this point to cost of fuel in cents per kilowatt-hour, we obtain 57 cents, were the efficiency of transformation 100 per cent, but since it is assumed to be but 90 per cent, 11 per cent has to be added to this cost, as shown in the reduction table. This gives the cost of coal per kilowatt-hour 63 cents, as against .33 for the condensing engine.

There remains to be included in the operating expenses for this station, water, oil, small supplies, repairs, superintendence and general expense, which I have estimated at .093 cent per kilowatt-hour. The total operating expense foots up to .58 cent, which, added to the fixed charge of .4 cent, makes the total cost power from standard .98 cent, or very nearly one cent per kilowatt-hour.

Before comparing the costs from the various steam plants I will review briefly the circumstances governing the production of power by water.

The application of water-power to street railways has the following points of advantage: In plants operated under any but very low heads the generating machinery may be installed at a less cost than for steam. The fuel expense also disappears, as well as a portion of the cost of repairs. A part of the labor expense will be saved, inasmuch as no engineers, firemen or coal handlers are required.

The main disadvantage in the application of water-power to street railway operation lies in the fact that generally railroad power stations are quite distinct from waterfalls, and that it is very expensive to transmit the electrical energy to any considerable distance, the distance of transmission being hundreds of miles for the majority of street railways. That it may be made more profitable to employ water-power when its location is nearby the road and the price of coal is high also, there can be no doubt.

The cost to produce power from water is often compared with the cost to produce from coal on the basis of continuous operation for 24 hours a day. For street railway service this method gives a false impression, since it implies that the machinery is working at its full capacity for 8,760 hours per annum, or 100 per cent load factor; as a matter of fact, for street railway service a load factor of 33 per cent is high.

To look at this from another point of view, the demand for power for street railways can not be increased at will, as it may be in a manufacturing concern. In the latter, if it is found advisable to run night and day at full capacity, instead of ten hours, there is produced a correspondingly greater amount of the product, be it flour, steel rails or carbide of calcium, and this output is produced at a correspondingly decreased cost per unit. For street railway service, on the other hand, there has to be installed sufficient machinery to take the peak of the load.

This is usually three times the average, and is only of a few hours' duration each day. If it were necessary or profitable to use this full capacity continuously for other industries it would be possible to do this with very little increase of labor, no increase of fixed charges and the additional expense of producing the greater output would be merely the coal and a slight increase of supplies and repairs. This combination is the feature of the Niagara work.

When the expense of transmission shall have been decreased by the successful employment of higher voltage, it will then become a problem as to whether it will not be profitable to produce power from a steam plant located at a coal mine, coal costing, in this case, but 80 cents a ton. This would bring the cost of fuel down to .12 cent per kilowatt-hour, as against .33 cent for standard plant. Further, this expense would only continue for the comparatively small number of hours that the plant would have to be operated for street railway service. This might be better economy than to pay the fixed charges that would accrue from the expensive development of water-powers at possibly much greater distances. It is to be noticed in this connection that the cost of installing the steam station would be considerably less when located at the coal mine, since it would then be unnecessary to equip with the most economical and expensive machines.

Water-power produced in various parts of the country varies greatly in its cost. It is reported that the electrical energy so produced costs from $14 to $32 per annum per kilowatt continuous output. This expense is largely made up of fixed charges, which increase rapidly, as the expense of making the necessary improvements is greater. The standard steam plant produces power with $3 coal for $29, and with 80-cent coal for $22 per kilowatt per annum, which compare very favorably with the above for water-power.

A disadvantage occurring in the use of water-power is that in some cases on account of certain periods of low water an auxiliary steam plant has to be kept in reserve, which is, of course, an additional expense. There can be no general rule given that will determine whether it is more advantageous to use water or steam power. Each case must be figured by a competent engineer and decided on its merits.

The great majority of street railways being operated by steam, I shall not dwell longer on water-power, as there is considerable ground to be covered in the consideration of the steam stations. I have compiled and classified the data on representative ones throughout the country; tables No. 1 and No. 2 give the results.

The general arrangement of the tables is as follows: Each vertical column contains the data for a different station during a stated period. Each station is represented by a number, which appears at the head of the column; only a portion of the table is exhibited to you on the large diagram for obvious reasons, but I will describe the different items as they appear in the completed table. The first column is headed S, for standard station; following down the column, first comes the capacity expressed in multiples of 1,000 kilowatts, 3.6 meaning 3,600 kilowatts. The number of units of engines three, ditto for generators three, number of units engine per 1,000 kilowatts capacity is .83, obtained by dividing 3 by 3.6; ditto for generators .83. The next line under type is a description as to whether the engines are belted or direct-connected to the generators. B for the former and D C for the

TABLE No. 1.—SHOWING COST OF OPERATION OF POWER STATIONS.

No. of Station.		S.	1	2	3	4	5	6	S.	1	2	3	4	5	6	S.	1	2	3	4	5
Cap. in 1,000 k w		3.6	.6	2	1.6	12.68	2.38	.744	3.6	.6	2	1,6	12,68	2.38	.744	3.6	.6	2	1 6	12,68	2.38
Type.	Units E	3	3	2	2	8	7	4	3	3	2	2	8	2	4	3	3	2	2	8	2
	Units G	3	3	2	2	8	7	12	3	3	2	2	8	7	12	3	3	2	2	8	7
	Units E per 1000 k w	.83	5	1	1.25	.63	.84	5.4	.83	5	1	1.25	.63	.84	5 4	.83	5	1	1 25	.63	.84
	Units G per 1000 k w	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94
	B. D. C	D C.	D.C.	D.C.	D.C.	D.C.	B.	B.	D.C.	D.C.	D.C.	D C.	D.C	B.	B.	D.C.	D.C.	D C.	D.C.	D.C.	B.
	S. C. T	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.
	N. or C	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.
Period.	Days	365	365	343	365 -1897-	365	365	365	31	31	31 -Janu	31 a r y.	31 1897-	31	31	30	30	30 Septe	30 mber,	30 1897-	30
Load Factor.	Per Cent	33⅓	22.3	33.6	46.4	34.8	52.2	47	33⅓	30	50.6	58.6	46 4	64	48.4	33⅓	17.7	28	43.2	27.6	42.6
	Per Cent. of S	....	67	101	139.5	104	157	141	....	90	152	176	140	192	145.5	....	53 2	84	130	83	128
Labor.	Shifts	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Duration	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Shift-hours	8,760	8,760	8,232	8,760	8,760	8,760	8,760	744	744	744	744	744	744	744	720	720	720	720	720	720
	Men per 1000 k w	1.94	4.67	2.91	3.36	1.9	4 79	5.95	1 94	4 66	2.95	3.24	1.93	4.93	6.86	1.94	4.96	3	3.8	1.77	4.5
Cost in Cts	Rate-pay	27	26 8	25.7	25.8	28.6	26.6	25.3	27.	26.5	26.2	25.	29.	25.8	25.6	27.	25.	25.6	24.4	28.4	27.6
	Per k w hour	.157	.56	.223	.187	.156	.243	.321	.157	.41	.153	.138	.121	.198	.336	.157	.705	.273	.215	.182	.292
	Per Cent. total op	27.	46.7	32.5	29 4	22.6	28 7	29.1	27.	47.	27.2	23.	18.3	26.8	27.7	27.	51.4	40.6	32 5	25 9	31.8
	Per Cent. S	....	356	142	119	99.1	154	204	....	261	97.4	88	77	127	214	....	448	174	137	116	186
Fuel.	Lbs. per k w hour	2.2	3.18	2.48	2.61	2.86	3.24	4.13	2.2	3.07	2.36	2.65	2 74	3.19	4.74	2.2	3.3	2.34	2.48	2.84	3.3
	Price per short ton $	3	2.6	2.62	2.6	2.72	2.6	2.9	3	2.75	2.65	2.54	2.88	2.71	3.08	3	2.48	2.56	2.53	2.43	2.56
	Kind, A or B	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B	B.	B.	.3 A. .7 B	.25 A. .75 B.	.3 A. .7 B.	R.	.2 A. .8 B.	B.	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.
Cost in Cts	Per k w hour	.33	.414	.325	.340	.389	.42	.599	.33	.421	.313	.337	395	.430	.729	.33	.409	.299	.314	.345	.423
	Per Cent. total op	57.	34.5	47.4	51.6	55.2	49.7	54.3	57.	42.	55.6	56 4	59.9	58.4	60.1	57.	29.8	44.3	47.5	48.8	46.1
	Per Cent S	....	125.5	98.5	103	117.5	127	182	....	127.5	94.5	102	120	130	220	....	124	91	95	104	128
Repairs, Supplies & Sup't. & Gen. Exp.	Per k w hour	.093	.225	.138	.132	.159	.182	.182	.093	.172	.0975	.123	.144	.109	.147	.093	.258	.102	.133	.176	.203
	Per Cent. total op	16.	18.8	20.1	20.	22.6	21.6	16.5	16.	17.	17.2	20.6	21.81	14.8	12.2	16.	18.8	15.1	20.	25.1	22.1
	Per Cent. S	....	242	148	142	171	196	196	....	185	105	132	155	117	158	....	278	110	143	189	218
Total Oper. C nts.	Per k w hour	.58	1.198	.686	.639	.704	.845	1.102	.58	1.003	.563	.598	.66	.737	1.212	.58	1.372	.674	.602	.703	.918
	Per Cent. S	....	205	118	114	122	146	190	....	172.5	97.	103	114	1.7	208	....	236	116	114.5	121	157
Fixed Charges	Per k w hour	.405	....	....	....	....	....	....	.405	....	....	....	....	....	....	.405	....	....	....	....	....
	Per Cent. total op	70	....	....	....	....	....	....	70	....	....	....	....	....	....	70	....	....	....	....	....
	Per Cent. S	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Grand Total		.985	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

latter. The two lines marked S C T and N or C refer to engines, simple compound or triple non-condensing or condensing, as in standard; C C is compound condensing.

The period during which the averages are taken is given in days. Load factor is in per cent. Inserted in the proper place under costs are the per cent S, and per cent total, which figures represent the per cents the items bear to the corresponding ones for standard, and to the total operating expense respectively.

The number of shifts, duration in hours and shift hours, together with the rate of pay of men, in cents per hour, and number of men per shift per 1,000 kilowatts capacity complete the data necessary for the analysis of the cost of labor. Costs are all expressed in cents per kilowatt-hour. Opposite fuel, pounds of coal per kilowatt-hour and price, which is dollars per short ton, give the necessary figures to analyze the cost of fuel per kilowatt-hour. Kind A or B refers to anthracite or bituminous.

Repairs, supplies other than coal, that is, water, oil, waste, lamps and miscellaneous, as well as superintendence and general expenses, are treated as one item, hereafter called general expense.

TABLE No. 2.—DATA ON "OPERATION OF POWER STATIONS."

No. of Station.	S	10	11	12	13	14	15	16	17	18	19	23	25	26	29	30	31	32	33	34	35	37	40	42	43	44	45	47	48	50
Cap. in 1,000 k. w.	3.6	.4	1.4	1.0	2.6	1.6	1.6	1.6	.8	.4	3.0	.6	4.0	.8	1.9	1.7	.9	5.3	1.5	2.0	1.2	1.5	9.2	1.8	3.3	6.0	1.0	.75	.6
Type: Units E	3	2	5	3	4	4	10	8	2	2	6	3	10	7	5	5	3	5	4	4	1	3	6	3	5	6	4	4	2	2
Units G	3	2	8	7	4	4	16	8	4	3	6	3	19	12	5	5	3	30	12	4	1	11	6	6	10	12	7	4	2	2
B. or D. C.	D.C.	D.C.	B.	B.	D.C.	B.C.	B.	B.	B.	B.	D C.	B.	B.	B.	B.	B.	B.	B.	B.	D.C.	D.C.	B.	D.C.	B.	B.	B.	B.	B.D.C.	D.C.	D.C.
S. C. T.	C.	C.	S.	C.	S.	S.C.	S.C.	C.	C.	S.	....	C.	S.	S.	C.	C.	C.	C.	C.	C.	C.	C.S.	C.	B.	C.	B.	C.	C.	C.	C.
N. or C.	C.	C.	N.	C.	N.	N.C.	N.C.	C.	C.	N.	....	C.	N.	N.	C.	C.	C.	C.	C.	C.	C.	C.N.	C.	C.	N.	C.	C.	C.	C.	C.
Period—Days	365	1	365	365	365	365	183	365	365	365	31	183	365	365	365	365	365	365	365	183	365	151	365	365	365	365	80	168	365	....
Load Factor—Per Cent	33½	24	×	23	42	19	41	33	24	....	16	16	33	19	27	23	32	31	16	57	87	11	36	45	15	30	26	20	35	....
Taken from Car-miles	....	....	×	....	....	....	....	....	×	....	....	×	....	....	....	....	....	....	....	....	....	....	....	....	....	....	×	×	....	....
Shifts	8	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	3	2	2	2	2
Duration	8	....	12	12	12	12	12	8	12	12	12	12	12	12	10	10	10	12	12	12	12	12	8	8	12	8	10	12	10	10
Shift-hours	8,760	....	8,760	8,760	8,760	8,760	4,380	8,760	8,760	8,760	4,380	4,380	8,760	8,760	7,300	8,760	7,300	8,760	8,760	4,392	8,760	3,624	8,760	8,760	8,760	8,760	660	4,380	7,300	7,300
Men per 1,000 k. w.	1.04	7.5	3.7	3.7	3.0	1.87	6.3	3.7	3.7	3.7	8.0	3.3	3.2	5.0	3.2	3.0	4.5	3.5	5.0	5.0	4.1	8.0	5.0	5.0	3.7	3.3	3.0	8.0	6.7	6.7
Rate of Pay	27	18	20	20	22	16	16	20	18	12	17	25	21	17	21	21	20	20	20	20	26	16	26	26	16	24	15	12	15	15
Cts. per k w Hr.	.137	....	.32	.31	.16	....	.25	.23	.38	....	....	.51	.23	.37	.25	.27	.23	.33	.62	.18	.15	1.1	.17	.29	.39	.26	.45	.41	.29	.29
Lbs. per k w Hr.	2.2	....	0.7	4.3	0.5	....	0.5	5	5	.75	.50	6	5.6	6.8	3.9	3.3	4.4	3.5	4.3	5.3	4.7	7.3	3.7	5.7	3.7	3.5	4.7	5.1	3.3
Price ($) per Ton	3	2	2.24	2.98	1.44	....	2.10	3.30	1.43	....	....	8.41	1.05	1.15	2.80	3	2.94	3	3.06	1.0	1.24	1.75	2.70	1.60	1.60	1.60	1.90	2.12	2.78
Kind—A. or B.	B.	.5 A. .5 B.	A.	B.	B.	....	B.	B.	B.	B.	....	B.	....	....	....	B.	B.	B.	B.	B.	B.	.5 A. .5 B.	.6 B. .4 A.	A.	A.	A.	B.	.5 A. .5 B.	B.
Cts. per k w Hr.	.83	....	.75	.63	.47	....	.68	.83	.36	....	....	1.03	.53	.89	.55	.40	.62	.52	.66	.27	.20	.63	.50	.45	.14	.28	.45	.54	.21	.28
Gen. Ex.—Per k w Hr.	.093	....	.33	.11	.09	....	.14	.09	.06	....	.08	.16	.55	.06	.23	.15	.19	.09	.22	.12	.04	.12	.11	.18	.14	.15	.05	.21	.28	.28
Total Op.—Per k w Hr.	.98	1.5	1.4	1.05	.72	....	1.07	1.15	.70	....	1.7	1.	....	1.02	1.03	.91	1.1	1.5	.66	.57	.46	1.85	1.03	1.03	1.03	.60	.66	1.16	1.02	1.02
Fixed Charges	.405	....	....	.44	.24	....	.24	....	....	....	....	....	....	....	....	....	....	....	....	.27	.26	....	....	.50	.39	.26	.24	.45	.54	....	....

A supplement to the tables, in order to more clearly illustrate the relation of the costs, I have constructed diagrams in which these are represented by different characters of lines as to shading.

It will be noticed that these shaded lines are of various heights, their height corresponding to the cost of the power in cents per kilowatt-hour. Four kinds of shading are used: Horizontal, equaling general expenses; vertical, cost of coal, and diagonal, cost of labor; these, which are operating expenses, are laid out above the line, and black, equaling fixed charges, is plotted below the line. The distance from the base line 0 up to 1 represents one cent, and the magnitude of each item is denoted by the length of its color. The diagram for table No. 1 is laid out in six groups, one group for each station. The first or left hand column in each group represents the costs for the standard station. You will notice that its total length, including the black, is about equal to the distance between 0 and 1, so that, including fixed charges, the cost of power per kilowatt-hour per annum for the standard station amounts to about one cent. It also appears that the fixed charges are approximately equal to the coal. Labor is roughly about half the coal, and general expense about half the labor. These proportions are simply and easily remembered, and we might expect them to hold approximately for stations under similar governing conditions.

I shall next call to your attention station No. 3, whose equipment differs from the standard, as follows: It has two units instead of three; each generator is 800 kilowatts, making a capacity of about one-half that of the standard; the generators and engines are direct-connected, the latter being compound-condensing, smaller, of course, than the standard, but in other respects similar. Three 500 horse-power water-tube boilers, economizers and heaters complete the important part of its equipment.

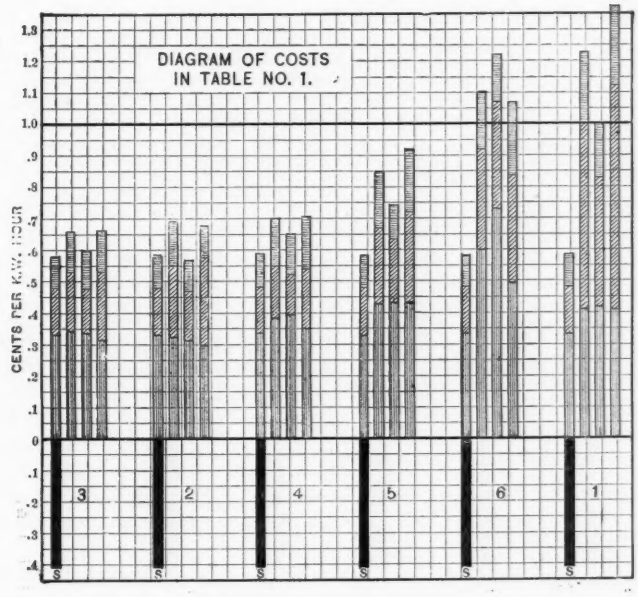


DIAGRAM OF POWER COSTS.

(To be concluded.)

LITERARY.

The ELECTRICAL REVIEW is in receipt of a chart showing the mineral products of the United States from 1888 to 1897, sent out by Mr. David T. Day, Chief of the Division of Mineral Resources of the Department of the Interior. These figures are preliminary to the official report which should be ready for distribution about the close of the year. Copies of this chart can be secured by writing to Mr. Day at Washington.

Why Telephone Companies Should Advertise.

Everybody hasn't a telephone who ought to have. Everybody who has a telephone hasn't the 'phone he ought to have.

Everybody who has a telephone does not make all the use of it possible. Those of the public who are telephoneless do not use the public stations as much as they might.

While these conditions exist, it is possible to profitably advertise the telephone service in the newspapers.

Newspapers are particularly adapted to the purpose of giving publicity to the merits of the telephone. Every one intelligent enough to use a telephone is a reader of newspapers. And every possible subscriber to the telephone is already a subscriber to the newspaper.

The use of telephones extends outside of the business world to residences where the newspaper goes. Its advantages to the housekeeper can best be made known through the newspaper, which visits the house daily, and brings the intelligence of happenings and of bargains.

Seldom is a telephone removed when once placed in a house, but trivial objections, that could be overcome by advertising, prevent many a housekeeper from enjoying it.

One does not realize the advantages of a thing so well as when deprived of it, and the advantages of a house telephone are not so apparent as to place it in the category of necessities until it has been tried.

Therefore, educational work is needed, and the newspaper is the best educational medium.

Business men who have telephones do not always have the service they should have; from motives of economy an inferior service is used, whereby both the user and the telephone company suffer.

The advantages of the best service should be continuously kept before telephone subscribers.

In my own office I first put in a party line instrument, which I thought ample. A business man who knew more about telephones told me I was not doing myself justice. An investigation of the matter determined me to get the best service there was, and although the cost was double, I have not regretted the change.

Where there is more than one telephone company, the need for advertising is greater, and the company that neglects it neglects a business proposition.

Surely each company has advantages to offer, else it would not continue long in existence; and surely neither company has all the business it wants or can handle.

The fact that solicitors are employed who can see every possible customer and explain the advantages is no reason why advertising can not be used. In fact it is one of the reasons why it should be.

Solicitors have easier work where the merits of a thing they are advocating are known; and solicitors frequently overdo the thing, and do not get the serious attention their article deserves. But the newspaper advertisement is a silent argument that no business man objects to. If it talks sense and appeals to his reason, it gains an audience.

In New York city the number of telephones was materially increased by newspaper advertising. The telephone company, years after the merits of the service were known to over 17,000 subscribers, found that there were plenty of people needing telephones who did not have them. And they found that the quickest way to reach them was through the papers.

The way they did it was by inserting daily changes of small ads., alternated with larger ads., giving more argument and more reason for the use of telephones.—*Frederick Vail Owen, in Sacramento Bee.*

Executive Committee Meeting at Wilmington, Del.

Chairman Ellett, of the executive committee of the Association of Fire and Police Telegraph Superintendents and Municipal Electricians, has issued a call for a meeting of his committee for October 8 and 9, at Wilmington, Del., the home of the president of the association, Mr. John W. Aydon. The following gentlemen compose the committee:

W. Y. Ellett, superintendent fire telegraph, Elmira, N. Y., chairman; M. W. Mead, city electrician, Pittsburgh, Pa.; Capt. William Brophy, chief electrician, wire inspection department, Boston, Mass.; W. H. Thompson, city electrician, Richmond, Va; E. C. Mason, superintendent police telegraph, Brooklyn, N. Y.

The committee at this meeting will revise the by-laws of the association and decide upon matters pertaining to the next regular meeting of the association, which will be held at Wilmington, Del., September 5, 1899. All members of the association are invited to be present at this meeting of the executive committee on October 8 and 9, President Aydon having arranged to entertain all who can make it convenient to attend.

Applications for membership will also be received and acted upon at this meeting.

ELECTRIC LIGHT FLASHES.

An electric light plant is to be established at the State House of Refuge, Albion, N. Y.

The Cayadutta Generating Company has purchased the electric light plant of Streeter Brothers, of Fonda, N. Y., which includes the franchises for the villages of Fonda and Fultonville. The transfer is to take place November 1.

The Stevens Point, Wis., Lighting Company has been placed in the hands of a receiver. The capital stock is $50,000. The action is an outgrowth of foreclosure proceedings instituted by the First National Bank, of Milwaukee, which holds its paper.

At the annual meeting of the stockholders of the Marion, Ohio, Electric Light and Power Company, a board of directors for the ensuing year was elected, consisting of C. W. Leffler, E. Huber, E. Durfee, H. B. Hane, W. L. Warner, C. Harraman and H. Strelitz.

At a meeting of the stockholders of the Standard Electric Light, Heat and Power Company, of Avoca, Pa, the resignations of A. H. and L. E. Squiers and E. J. Jordan, of Tunkhannock, and J. M. Garman, of Wilkesbarre, were presented and accepted, and the following stockholders were elected to fill the vacancies: W. H. Hollister, Avoca, president; Dr. J. A. Bullard, vice-president; J. B. Russel, secretary and treasurer.

The Westinghouse Electric and Manufacturing Company has just equipped a train on the Canadian Pacific Railroad with a complete electric lighting plant. Each car is supplied with a dynamo operated from the axle by a sprocket while the train is in motion. While the cars are standing still the light is supplied from a storage battery.

Chicago Electrical Association.

The Fall and Winter programme of the Chicago Electrical Association, whose meetings are held at 1736-41 Monadnock Building, Chicago, is as follows:

October 7, 1898, "Electrical Features of the Late Spanish-American War," Thos. G. Grier, Western Electric Company.

October 21, 1898, "Practical Points on Electrical Measurement," W. B. Hale, cable-testing department, Western Electric Company.

November 4, 1898, "The Electrical Equipment of a Model Printing Establishment," George A. Damon, electrical engineer, with B. J. Arnold.

November 18, 1898, "The Development of the Motor-Cycle," F. B. Rae, electrical engineer.

December 2, 1898, "Practical Points in Street Railway Engineering," W. A. Harding, master mechanic and electrician Calumet Electric Street Railway.

December 16, 1898, an address by Arthur V. Abbott, chief engineer Chicago Telephone Company, on "Wireless Telegraphy" (illustrated by apparatus).

January 6, 1899, "Telephone Engineering—Some Problems, Solved and Unsolved," S. G. McMeen, chief engineer Central Union Telephone Company.

January 20, 1899, "Observations on Ventilating Fans," Gerard Swope, Western Electric Company.

Communications should be addressed to the secretary J. R. Cravath, 825 Monadnock Building, Chicago.

On the Electrical Properties of the Vapors from the Carbon Arc.

This was the title of a paper read before the recent Boston meeting of the American Association for the Advancement of Science by Ernest Merritt and O. M. Stewart. The air, as well as other gases, is usually a non-conductor, except when at a very high temperature. The gases from a flame, however, are, to some extent, conductors of electricity. They possess the power, for example, of discharging an electrified body with which they come in contact. Other gases acquire this discharging power when acted on by X rays and retain it for a fraction of a second. The authors find that the vapors from an arc light behave in almost exactly the same way as do gases which have been acted on by X rays, except that they retain their discharging power longer. If the vapors are drawn from the arc through glass or metal tubes, and caused to pass between a charged body and one that is grounded, the former will gradually lose its charge. The discharge current is, however, not proportional to the potential difference, but increases less rapidly than the latter, and approaches a limiting value. If the vapor of water is introduced into the arc, the rate of discharge is greatly increased. All the phenomena observed may be explained upon the assumption that the air is "ionized" by passing through the arc; i. e., the molecules of air are to some extent torn apart, so as to form positive and negative ions, as in electrolysis. These ions rapidly recombine, and their number being limited, the maximum current that can be carried by the vapor is relatively small. The experiments probably have an important bearing upon the theory of conduction in the electric arc.

TELEPHONE NEWS AND COMMENT.

The Erie Telegraph and Telephone Company added 756 subscribers to their system during the month of August. Total number connected September 1, 27,677.

The American Telephone and Telegraph Company has laid a cable across the Missouri River at St. Charles, Mo. The cable is two and one-half inches in diameter, 2,300 feet long and weighs five tons.

A mortgage for $1,000,000 was recorded on September 23, given by the State Telephone Company, of Newark, N. J., to the Fidelity Trust Company, of that city, and covering all the lines of the company in the state.

The Newark Telephone Company has applied for a franchise at Summit, N. J. The rates offered are $36 yearly for residences and $30 for business houses. The company proposes to have telephone connection with New York city by subscribing for a Bell telephone to be placed in its central office.

Everybody should have a telephone, and Fred Hackman, of Meire Grove, Minn., knows it. He says that if the people of Melrose, five miles from Meire Grove, will furnish and set the poles, he'll supply the telephones and wire for a line connecting the two places. Bully for Fred!

A party composed of C. E. Yost, L. H. Korty, E. M. Morsman, Vance Lane, all of the Nebraska Telephone Company, and E. C. Baker, general manager of the Iowa Union Telephone Company, with headquarters at Davenport, Iowa, visited Omaha, Neb., recently and inspected the new telephone exchange.

The Premiers of Australia have decided to meet in Sydney to discuss the new phase of the Pacific cable question, to the effect that Canada contribute two-ninths to the building of the cable from Vancouver to Sydney, Great Britain three-ninths, and Australia, as most largely interested, four ninths. They will also consider the practicability of connecting the British cable with an American cable at Hawaii, running from San Francisco to those islands.

The recent extensive purchase of telephone property in the Northwest, by the Erie Telephone and Telegraph Company, is thus commented upon by the Boston News Bureau:

We understand that the purchase price of the 900 miles of independent telephone line in the Northwest, by the Erie Telephone Company, was $50,000.

Boston people do not realize the importance of the above purchase to the Erie Telephone Company. The independent telephone movement in the Northwest had assumed large proportions. There were five companies in the field with a capitalization of $360,000, all under the management of the Western Electric Telephone Company. These companies owned 3,000 miles of toll line in the Northwest, practically embracing the entire toll-line opposition in the states of Minnesota, Iowa and the Dakotas, and reached 300 points not reached by the Erie company.

The Erie company purchase was of the lines of the Union Electric Telephone Company, which is the only independent company paralleling the Erie company lines, but as a result of this purchase the Erie company agrees to place Bell instruments on all the Western Electric company's lines at a small rental which includes the cost of repairs, and both systems will be operated as one.

This is declared to be the first instance where a Bell company has ever entered into an extensive arrangement with an independent company; the previous policy has been to ignore or fight the independents. In this case there is no transfer of stock, other than of the Union company, and the independent companies maintain their separate existence and build and maintain their own lines.

This purchase is considered of great advantage to the Erie company, as it practically cuts off the new Minneapolis independent exchange from all toll connections, for undoubtedly in connection with the Western Electric Company's lines the Minneapolis company would have been able to make inroads on the Erie company's business. This agreement likewise cuts off a number of other independent exchanges in various cities, as under the agreement only toll lines are embraced, and it prohibits any affiliation with lines other than those using Bell instruments.

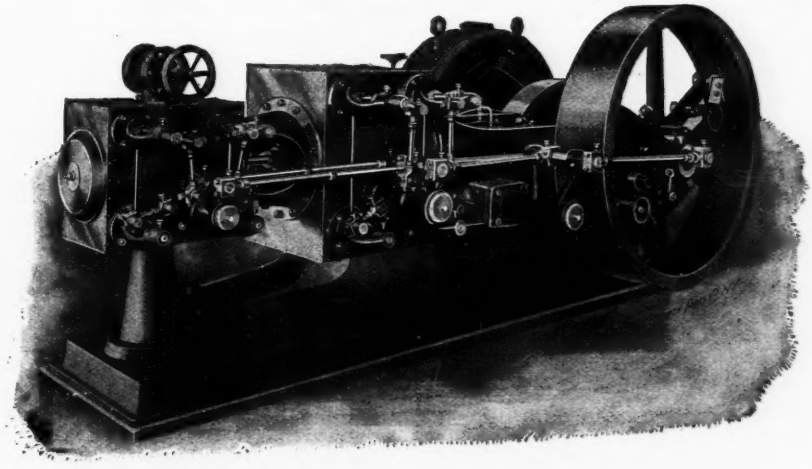
A New Corliss Engine.

The Ball & Wood Company, of New York city, have designed and built a new horizontal tandem compound engine, shown in the accompanying illustration. The manufacturers believe that this latest product of their shops embodies all the best features of the well known Corliss type, together with a number of important and interesting improvements designed by the engineers of the Ball & Wood Company, with the object of obtaining the best possible distribution of steam, close regulation and high efficiency.

The valve gear is generally Corliss in type, but is without the usual Corliss tripping devices or dash pots.

Instead of this, the admission valves are operated by an independent wrist plate. The exhaust valves are actuated by a second wrist plate by means of an adjustable eccentric, and both wrist plates are connected by the Ball & Wood inertia governor, which is well known to be one upon which extremely small variations of speed have an immediate corrective effect. The valves are multiported on both steam and exhaust cylinders, thus insuring quick and full admission of steam into the cylinders and prompt release at completion of stroke. The exhaust motion is very rapid, and by means of the independent eccentric any desired adjustment is obtainable. The steam valves have large openings, and being operated by the Corliss plate, quick angular motion is obtained.

It is evident that the economy of this type of engine should be exceedingly good, and its regulation as nearly perfect as is possible to attain in engine practice. These new engines are manufactured in large and small sizes, for railway and lighting service, and, in connection with the vertical and other types built by the company, enable the latter to furnish to customers practically any type of engine desired.



THE BALL & WOOD COMPANY'S NEW TYPE OF CORLISS ENGINE.

American Electrical Apparatus in Spain.

Even Spain shares in the general rush for American electrical machinery. The Westinghouse Electric and Manufacturing Company, through its London representatives, has installed one of its 135-kilowatt, single-phase, separately excited alternators, belted to a Westinghouse engine, for the Malaga Electricity Company, of Malaga, Spain.

The decay of Spain's power might be traced largely to the absence of engineering ability among her indolent population. She can not build her own machinery, and in most cases she is unable to operate it when it is built. The ambitious youth of the present day comes to America to study engineering, realizing that the field in his country is by no means overstocked. Meanwhile, American enterprise is installing American systems and American methods in Spain.

A Timely Pamphlet.

"Electric Street Railway History" is the title of a beautifully prepared pamphlet just issued by the Westinghouse Electric and Manufacturing Company, Pittsburgh. The various types of Westinghouse railway motors are described, as they have been developed to meet existing and improving conditions. The Westinghouse company has in operation to-day 18,712 railway motors, exceeding 600,000 horse-power. The pamphlet also illustrates the engine type generators built by the Westinghouse company for railway power stations.

ADVANCE INFORMATION

Electric Light and Power.

CHATTANOOGA, TENN.—The Rapid Transit Company will erect an electric light plant to be located in Highland Park.

LYNCHBURG, TENN.—An electric light plant will be established.

ATLANTA, GA.—The Mayor may be addressed concerning the establishment of a municipal electric light plant.

MADISON, MINN.—The new $7,000 electric light plant, which has been under construction for the past six weeks, is complete and in running order.

THORNTOWN, IND.—There is talk of constructing an electric light and waterworks plant at this place.

OXFORD, N. C.—A movement is on foot to establish an electric light plant in this city. Address Town Clerk.

GREENSBORO, N. C.—Steps are being taken to erect an electric power plant for manufacturing, and a more complete system of electric lights.

CHATTANOOGA, TENN.—The Heron Bedstead Company will erect a complete electric light plant in its factory.

FLORENCE, ALA.—The Florence Milling Company will put in an electric light plant in its mill.

SHERMAN, TEX.—An electric light plant is being established in this city.

ALLEGHENY, PA.—New machinery is being added to the Allegheny City electric light plant.

AUSTIN, TEX.—The McKinney Electric Light and Motor Power Company has been incorporated; capital stock, $17,000; incorporators, L. A. Scott, J. P. Nenny, D. T. Pardue.

PRATT CITY, ALA.—Paschal G. Shook and associates have received franchise for the establishment of a $9,000 electric light plant in this city.

WYNNE, ARK.—William M. Kennedy, chairman Board of Improvement, may be addressed concerning bonds to be issued for the erection of an electric light plant and construction of a system of waterworks.

NEW IBERIA, LA.—A. J. Cammack, secretary, may be addressed concerning erection of an electric light plant and construction of waterworks in the near future.

NEW ORLEANS, LA.—Cohn & Ber and T. M. Miller & Company have applied for franchises for the erection of electric light plants.

WILLIAMSPORT, MD.—Steps are being taken to erect an electric light plant.

New Telephone and Telegraph Companies.

LITTLE ROCK, ARK.—The American Telephone and Telegraph Company, recently incorporated, has received franchise to construct a telephone system.

MEYER, ILL.—The Missouri & Illinois Telephone Company has been incorporated, with a capital stock of $2,500.

SALEM, VA.—The Interstate Telephone and Telegraph Company has been granted franchise to construct and operate an exchange.

WOODRUFF, S. C.—The Home Telephone Company has been incorporated, with E. F. Pearson, president; L. H. Irby, secretary, and S. J. Workman, treasurer.

LUMBERTON, N. C.—The Robeson County Telephone Company, A. W. McLean, president, will construct a long-distance telephone line from this place to Wilmington.

CHARLOTTE, N. C.—J. A. Helvin is constructing a telephone system from this place to Salisbury.

FORDSVILLE, KY.—The work of erecting the telephone lines between this place and Owensboro is progressing rapidly, and will be completed in a few weeks.

ATLANTA, MO.—The Atlanta Telephone Company has been incorporated, with a capital stock of $2,700.

SPARTA, TENN.—The Gainesboro Telephone Company will probably extend its line to Crossville in the near future.

ATHENS, TENN.—The East Tennessee Telephone Company are soliciting subscribers for a new telephone exchange here, which will have regular connections with the East Tennessee Company's line.

OTTUMWA, IOWA—The Ottumwa Long-Distance Telephone Company has been incorporated to build a long-distance telephone line in the states of Iowa and Missouri; incorporators, J. C. Goddard, A. H. Cowdery and P. E. Wilcox; capital stock, $10,000.

FERGUS FALLS, ILL.—The Fergus Telephone Company is constructing a branch line to Pelican Rapids, and the work of stringing the wires has been begun. It is expected that the line will be in operation in a few days.

ROCKWOOD, TENN.—The East Tennessee Telephone Company will establish an exchange here.

MERIDIAN, MISS.—The Meridian Telephone Company has been incorporated by J. D. P. Lewis, J. P. Walker, Henry A. Coit, Henry A. Turner and others, with a capital stock of $16,000.

BOLIVAR, MO.—Franchise has been granted to J. C. Pike and H. S. Bruce for the construction and operation of a telephone exchange.

LURAVILLE, FLA.—The Luraville & Suwanee River Telephone Company has been incorporated by Thomas I. McIntosh, of Luraville; Sidney V. Hough, Lancaster, Fla; L. T. Boatright, of Live Oak, Fla.; William T. Dees, of Mayo, Fla., for the construction and operation of a telephone system; capital stock, $3,000.

New Incorporations.

DES MOINES, IOWA—The Postal Telegraph-Cable Company, with a capital stock of $50,000, has been incorporated for the construction and operation of telegraph lines within the state; incorporators, C. F. Fox, R. J. Wurst and R. W. Banks.

ELLWOOD, IND.—E. S. Lee, of Pittsburgh, representing an eastern company, formed to manufacture a new electric carbon and arc lamp, has located the industry at this place.

ST. LOUIS, MO.—The Electric Connecting Railway Company has been incorporated; capital, $2,000; incorporators, John H. Bobing, M. T. Chestnut and James D. Houseman, Jr.

NEW YORK, N. Y.—The Safety Third-Rail Electric Company, of this place, with a capital stock of $1,000,000, has been incorporated by the Secretary of State to manufacture and deal in electrical appliances and properties of every description here. The directors are Emerson McMillin, Emerson McMillin, Jr., W. F Douthirt, C. T. Schoville, R. H. Beach, William M. Keepers, David F. Halsted, John McLeod Murphy and Louis Steckler, of this place.

Increase of Capital.

ELYRIA, OHIO—The Elyria Telephone Company has increased its capital stock from $20,000 to $50,000.

ALBANY, N. Y.—The Commercial Cable Telegraph Company has increased its capital stock from $100,000 to $500,000.

TRADE NOTES.

The Storey Motor and Tool Company, makers of motors for special adaptations, of Philadelphia, have removed to 464 South Broad street, Trenton, N. J.

The Garvin Machine Company, Spring and Varick streets, New York city, has issued an elephantine postal card telling about some new and second-hand machine tools it has for sale.

The town of Somerville, Somerset County, N. J., has given the Berlin Iron Bridge Company, East Berlin, Ct., the contract for their new iron bridge. Span is about 60 feet, and the bridge has a clear roadway of 14 feet. The trusses will be of substantial latticed type. The floor will have steel beams and joists.

"The Hardy" incandescent lamp gained such a distinct success since it was first manufactured by the K. & W. Company, of Pittsfield, Mass., a little over one year ago, that now it is to be found in a great number of the best electrically equipped buildings throughout the country. The making of this lamp was undertaken by men who for years have been identified with the electrical field and the history of incandescent lamps, and who believed that the future improvement of incandescent lighting was in the development of a lamp which should reach a higher sustained candle-power than before attained. Aside from incandescent lamps, the K. & W. Company produce at their large and modern factory at Pittsfield other electrical specialties, such as commutator compounds, spark arresters, dynamo brushes and absolute cut-out hanger boards.

Even though, according to the calendar, the Summer is at an end, the demand for Western Electric fan motors continues. The public has become educated to the advantages of good ventilation, and the fan motor has been found to be one of the best means of preventing stagnation of air. It is useful for drying purposes in photograph galleries, engraving establishments and laundries. The Western Electric Company, which carries a complete line of iron-armored conduit, has recently increased its stock of conduit fittings.

A good example of the use of alternating current for short-distance transmission, ease of starting the motors from a distance, reversing the same, etc., is to be found in apparatus now being supplied for the Fitchburg, Mass., grain elevators by the Westinghouse Electric and Manufacturing Company. This consists of one 125-kilowatt two-phase generator, seven 20 horse-power and two 30-horse-power Westinghouse, type C, motors, to be used in operating carriers in elevators. The induction motor is especially adapted for work in dusty locations, such as the above, where the use of direct-current motors would be out of the question.

Paid Subscribers are what Counts!

The

Electrical Review

has them in

45 of the United States and Territories,

and in

32 Foreign Countries.

They Read the Paper and Read Your Advertisement.

Our rates for advertising are very low, considering the quality, character and extent of our circulation. Rates promptly sent on request.

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Times Bldg., New York

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED SEPTEMBER 27, 1898.

611,243 Safety fuse for electric circuits; G. W. Gardanier, Nyack, N. Y.

611,271 Electric railway; Oscar Preil, Washington, D. C.—Comprises a feed main, separate contact stations, circuit connections for the working current between each contact station and the feed main, each including a single electro-magnet, switching devices controlled by such magnets whereby the working circuit is made and broken, and circuit connections at each station, controlled by such switching devices, and each connected with the magnet in the working circuit of another station.

611,273 Means for supporting electric motors; L. T. Pyott, Philadelphia, Pa.

611,332 Elevator safety attachment; W. C. Preston, Providence, R. I.—Consists of four eccentrics arranged to clamp and hold the starting cord if pulled in either direction, springs to close each pair of clamps, an electric magnet held back of each eccentric to draw it from the cord when said magnets are energized, with wires to conduct an electric current to said magnets.

611,448 Apparatus for printing telegraphic messages; G. M. Gibson, Chulmleigh, England—A type wheel tending constantly to revolve, rings of pins revolving with it and pins, one for each ring of pins operated by the signals and each engaging with the pins of one of the rings.

611,460 Electric arc lamp; T. H. Pettengill, Amsterdam, N. Y.

611,461 Motor-mounting for electric cars; S. H. Short, Cleveland, Ohio—A motor-mounting for electric cars, consisting of a multipolar motor and an axle, and gearing connecting the same, said axle arranged to pass within the magnetic ring of the motor-field.

611,465 Controller for electric motors; H. P. Davis, Pittsburgh, Pa.—A reversing switch for two electric motors, comprising two movable members, an actuating device therefor, means for locking either or both of said members to said actuating device, and for detaching the same therefrom at will, and stationary contacts co-operating with said movable members.

611,466 Alternating-current measuring instrument; H. P. Davis, Pittsburgh, Pa.—Consists of a laminated core having an air gap, a primary actuating coil, a secondary coil, a disk armature having radii of different length, an indicating hand or pointer and a spring tending to hold said armature and pointer at the zero position.

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NOTICE IS HEREBY given that the Annual Meeting of Stockholders of the Electrical Review Publishing Company, for the election of a Board of Directors for the ensuing year and the transaction of such other business as may properly come before the meeting, will be held at the offices of the company, No. 41 Park row, in the city of New York, on the eighth day of October, 1898. The polls will be opened at three o'clock and closed at four o'clock, P. M.
Dated September 23, 1898.
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Drawings and specifications may be consulted and blank forms of proposal obtained at the Hospital, or at the office of I. G. Perry, Architect, in the Capitol at Albany, N. Y.

Each bid must be enclosed in an envelope, sealed and addressed to Joseph P. Dudley, President of the Board of Managers, Buffalo, N. Y., and endorsed, "Proposal for Installing Engine and Generator."

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Kindred.... ...Interests

The Carborundum Company, Niagara Falls, N. Y., has issued an illustrated catalogue of "Carborundum" and carborundum products, which should be in the hands of every one interested in the use of abrasives for grinding and polishing. The catalogue will be sent free on application.

The Builders' Iron Foundry, of Providence, R. I., have issued a new catalogue of grinding and polishing machinery, patent countershafts and wood-polishing wheels. The catalogue is three and one-half by six inches in size, contains 112 pages, and is conveniently and practically prepared.

The Western Telephone Construction Company, of Chicago, is sending out a new catalogue of its telephone apparatus and supplies, including everything necessary or desirable for a modern telephone exchange or for private line equipments. The catalogue is handsomely prepared, contains 136 pages, and may be had free for the asking.

The recent fluctuations in the prices on sockets, receptacles, cut outs, insulators, etc., have made it somewhat difficult for the ordinary buyer to keep track of the market prices on these goods. The Electric Appliance Company, Chicago, have just issued a special price-list of all of this material, giving trade prices that are strictly up to date. It is in the form of a small circular, which should be of considerable value to the purchaser of staple electrical supplies.

The John A. Roebling's Sons Company, of Trenton, N. J., have found the rubber-insulated wire field to be an exceedingly attractive one, and their new plant for the manufacture of this kind of electrical conductor has been running to its full capacity from the very start. The material turned out has been so satisfactory that the business is growing much more rapidly than was anticipated, and may require considerable addition to the present capacity of the mill in the near future.

The International Correspondence Schools, of Scranton, Pa., have issued a booklet describing their course in correspondence instruction in telephony. The papers for the course were prepared by Mr. Kempster B. Miller, a well known expert, who is the instructor for the International Correspondence Schools on this subject. The great and growing importance of the telephone industry is creating a demand for instruction in telephony which seems to be very well met in the course referred to. The booklet may be obtained free on application.

The New Britain Machine Company, New Britain, Ct., have just issued two very neat catalogues, one relating to the Case steam engine and the other to chain-saw mortisers. Both pamphlets are particularly neat and well illustrated, and will be sent on application to those interested. A very fine array of electric motors, connected with the No. 4 Case engine, is illustrated. Among these, showing the engines that are direct-connected, are the C & C dynamo, Eddy dynamo, Keystone dynamo, Riker dynamo, Lundell dynamo, Bullock dynamo, Crocker-Wheeler dynamo, Onondaga dynamo, etc.

The Electric Appliance Company, Chicago, have taken the general western agency of the Utility Shade Company, manufacturers of the Utility shades in paper and celluloid. These shades are something quite new in the electrical line and are destined to find a very large field, as they possess a great many points of merit, among which may be mentioned the following: They are very light in weight, neat in appearance and practically indestructible. They require no separate shade-holder and are low in price. They are made in a number of different shades and colors. The Electric Appliance Company has issued a special catalogue of these goods, which they will be pleased to send to the trade upon application.

The new nickel-alloy tube that Hermann Boker & Company, of 103 Duane street, New York city, are selling for use in gas engines, will doubtless make a great improvement in the construction of those engines. Heretofore the old steel ignition tube has been a source of great trouble and expense to users of such engines by making it necessary to change the tube every few weeks, and to use constant care in keeping it free from scales. By means of the nickel-alloy tube, it is claimed, a more uniform heat is thrown out, the tube getting red-hot all over, and its lasting possibilities are over double that of the steel tube. The pipe is of one-fourth-inch size running through the center of the flame, and is of such construction that it requires no bushing. Where the steel tube lasts but from three to five weeks, the nickel-alloy placed in the same way will, without any extra attention, endure from seven to nine months. For two years before placing the tube on the market it was thoroughly tested, and since its appearance it has been adopted by nearly all the leading gas engine companies. To more fully introduce the tube to the trade, Hermann Boker & Company offer to send it free for a 10 days' trial to any of those desiring to try its merits.

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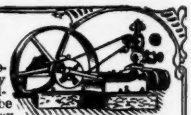

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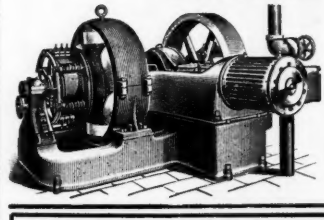

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